Infrastructure Construction Phase

Candlestick Point / Hunters Point Shipyard Phase II Redevelopment Project San Francisco, California

HPAP MASS GRADING, DEMO, & UTILITY PHASE II IMPROVEMENT PLANS

PROJECT MANUAL BID SPECIFICATIONS

VOLUME 2 TECHNICAL SPECIFICATIONS

Prepared By:
Lennar/CP Development Co., LP; HPS Development Co., LP
1 Sansome Street
Suite 3200
San Francisco, California 94104

in conjunction with:
BKF Engineers

August 12, 2015

TABLE OF CONTENTS

TECHNICAL SPECIFICATIONS

DIVISION 2 – SITEWORK

02050	Demolition
02140	Dewatering
02200	Earthwork
02225	Excavation, Backfilling and Compacting for Utilities
02512	Low Pressure Water
02513	Reclaimed Water
02536	Separated Storm Drain
02537	Separated Sanitary Sewer
02580	Signing, Pavement Markings, and Curb Painting
02740	Asphalt Concrete Pavement
02810	Irrigation System
02920	Structural Soil
02921	Soil Preparation
03300	Cast-in-Place Concrete
03480	Precast Concrete Utility Structures
13111	Cathodic Protection
16010	Electrical General Provisions

Appendix A	SFWD Standard Drawings
Appendix B	SFPUC Video Survey Requirements for Sewer Assets
Appendix C	SFPUC Instructions for Certified BFP Assembly Testers

SECTION 02050

DEMOLITION

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

A. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), Latest Edition, also referred to as "City Standard Specifications."

B. Standard Plans of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SPDPWSF), Latest Edition, also referred to as "City Standard Plans."

C. Department of Public Works (DPW) Order No. 176,707 "Regulations for Excavating and Restoring Streets in San Francisco", approved March 26, 2007.

D. Design Geotechnical Exploration Report, Alice Griffith Housing Redevelopment Infrastructure Improvements, prepared by ENGEO, dated 18, September, 2013.

E. California Health and Safety Code

1.2 RELATED SECTIONS

Section 02200, "Earthwork"
Section 02225, "Excavation, Backfilling and Compacting for Utilities".

1.3 SUMMARY

A. Section includes (but is not necessarily limited to):
1. Demolition and removal of existing improvements as indicated on the Drawings
2. Requirements for addressing complaints received by the Contractor

B. Full compensation for conforming to the requirements of this Section shall be considered as included in the Contract Lump Sum Price and no additional compensation will be allowed therefore.

C. Information for the Contractor's use in preparing the demolition plan is provided in this Section.

1.4 DEMOLITION PLAN

A. The Contractor shall submit a complete demolition plan to the Owner's Agent detailing procedures and sequence of the work, including traffic signing, salvage, disposal, and material handling.

B. The Contractor shall thoroughly investigate the existing conditions at the site before proceeding with the demolition plan.

C. The demolition plan shall consist of the following:
   1. The removal sequence for all items.
   2. Equipment locations during removal operations.
   3. Temporary support shoring or temporary bracing, if necessary.
   4. Details and locations of shields or other protective measures in sufficient numbers to assure that people, property and improvements will not be endangered.
   5. Items designated for salvage and date when and location where salvaged items will be delivered.
   6. Items designated for disposal and location where disposed items will be transported.

D. Approval by the Owner's Agent of the demolition plan or field inspection performed by the Owner's Agent will in no way relieve the Contractor of full responsibility for the demolition plan and procedure.

1.5 PROJECT CONDITIONS

A. Special care shall be exercised to protect the finishes of existing paving and other items to remain.

   1. Damage or disturbance to the existing pavement, curbs, sidewalks or other existing services shall be promptly restored, repaired, or replaced to match the existing condition at no additional cost to the Owner.
   2. If the Contractor has any question as to the extent of items to remain, he shall notify the Owner's Agent and request clarification before proceeding.

B. Damage: Promptly repair damage caused by demolition operations to existing facilities to remain and adjacent facilities as directed by the Owner's Agent and at no additional cost to the Owner. If the finished surface of the asphalt concrete on existing City streets is damaged, including by direct operations, haul trucks, movement of construction equipment, or other Contractor actions, then it shall be repaired to the satisfaction of the City and the Owner's Agent. Corrective work shall be at the Contractor’s expense.

1.6 TRAFFIC

A. The following additional requirements apply to the work that may require closing roadways to traffic for only brief periods of time.
   1. The closure of roadways to public traffic shall conform to the applicable requirements of City Standard Specifications.
   2. Conduct demolition operations and the removal of debris to ensure minimum interference with streets, walks, and other adjacent occupied or used facilities.
   3. Do not close or obstruct streets, walks, or other occupied or used facilities except to the extent indicated on the Drawings.
   4. Prior to closing a roadway to traffic, the Contractor shall have all necessary workers, materials, and equipment at the site as needed to proceed with the work in an expeditious manner. While the roadway is closed to traffic, work shall be pursued promptly and without interruption until the roadway is reopened to public traffic.

1.7 UNDERGROUND UTILITIES

A. The Contractor's attention is directed to the existence of certain underground facilities under and in the vicinity of the Work area that may require special precautions be taken by the Contractor to protect the health, safety and welfare of workers and the public. Facilities requiring special precautions include natural gas; and underground electric supply system conductors or cables, with potential to ground of more than 300 volts, either directly buried or in duct or conduit which do not have concentric grounded conductors or other effectively grounded metal shields or sheaths.

B. The Contractor shall notify the Owner's Agent and Underground Service Alert - Northern California (USA): 1-800-227-2600 at least 48 hours prior to performing any excavation or other work close to any underground pipeline, conduit, duct, wire or other structure.

C. If such facilities are not located on the Drawings in both alignment and elevation, no work shall be performed in the vicinity of said facilities until said facilities have been located and identified by the Contractor.

D. Service is to remain uninterrupted, unless directed otherwise by utility company or Owner's Agent. If it is necessary to interrupt service, Contractor must allow sufficient time for utility company to arrange for the continuation of required services. Regardless, Contractor must, at the minimum, notify all utility and service providers 48 hours prior to the start of the work of this Section.

1.8 HAZARDOUS WASTE IN EXCAVATIONS

A. If the Contractor encounters material in excavations that he has reason to believe may be hazardous waste, as defined by Section 25117 of the California Health and Safety Code, he shall immediately notify the Owner's Agent in writing. Excavation in the immediate area of the suspected hazardous material shall be suspended until the Owner's Agent authorizes resumption of work. If such suspension delays the current controlling operation, the Contractor will be granted an extension of time in accordance with the terms of the Contract.

B. The Owner reserves the right to retain an independent consultant for exploratory work to identify and determine the extent of such material and for removing hazardous material from such areas.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials and work involving alterations to existing construction shall conform to requirements of applicable Sections of the Contract Documents.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Demolition work shall, in general, be as indicated in the Contract Documents and shall consist of complete removal and disposal of the demolished materials.

B. All removed material, except that to be salvaged, stored on site and needed for backfill, shall become the property of the Contractor and shall be disposed of off-site in a legal manner.
   1. Concrete removed shall be broken into pieces, not larger than two (2) feet in the greater dimension, in such that the steel reinforcement bars will be segregated.
   2. Provide all necessary temporary enclosures necessary to protect pedestrians from possible injury.

C. Existing foundations to be abandoned: All existing foundations to be abandoned shall be removed to exposed native soil as determined in the field by the Owner's Agent (Geotechnical Engineer). All pile caps and footings shall be completely removed beneath areas of new improvements, slabs-on-grade, pavements, sidewalks, underground utilities, and landscaped areas. In general, single piles beneath these elements shall be removed to a depth of at least 10 feet below final soil subgrade and pile groups shall be removed to a depth of at least 10 feet below final soil subgrade. Single piles shall be removed to a depth of at least four feet below new utilities and pile groups shall be removed at least eight feet below new utilities, or to the top of Bay Mud, whichever is shallower. The geotechnical engineer may vary the depth of pile removal based upon site- specific conditions.

D. Abandonment of subsurface utilities and appurtenances:
   1. Slurry fill and cap the ends of the line with concrete. The concrete mic shall have a minimum shrinkage.

E. Demolition of subsurface utilities and appurtenances:
   1. Remove the utility and appurtenances and compact soil in trench according to the applicable sections of these Specifications.

3.2 COMPLAINTS

A. Demolition or Construction complaints shall be accurately recorded by the Contractor as to name of complainant, telephone number, address, date, time, nature of the complaint, name of the person receiving the complaint, the complaint investigation conducted, and the disposition of the complaint. Complaint records shall be kept at the Field Office and shall be available to the Owner's Agent at all times.

3.3 POLLUTION CONTROLS

B. Use water sprinkling, temporary enclosures, and other suitable methods as necessary to limit the amount of dust and dirt rising and scattering in the air to the lowest level of air pollution practicable for the condition of Work to protect adjacent buildings, automobiles and other property. Comply with all governing regulations.

C. Clean adjacent structures and improvements of all dust, dirt, and debris caused by demolition operations.

D. Return areas to condition existing prior to the start of the Work.

3.4 SALVAGEABLE ITEMS

A. Where required and when so directed by the Owner's Agent to be salvaged and/or reused, existing fixtures and equipment shall be removed in the most careful manner possible to avoid damage; and, if damaged, such items shall be restored to conditions satisfactory to the Owner's Agent.

B. Salvageable items include; but are not necessarily limited to: drainage structure castings, poles, light fixtures, valves, fittings, etc. All such items shall be delivered to the city yard having jurisdiction over the salvaged item.

3.5 CLEANING

A. Surfaces to remain, when cut, shall be carefully restored and refinished to provide a continuous, even finish to nearest intersections or edges.

3.6 SITE WASTE DIVERSION

A. Diverted waste shall be segregated from waste stream and stored in designated recycle or reuse areas. Recycled or reused materials not utilized for the project to be hauled to construction waste recycling facilities.

END OF SECTION

SECTION 02140

DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Dewatering system.
      a. The dewatering system shall remove accumulated groundwater from the excavations and maintain a water-free workplace within the excavations. Discharge of groundwater shall be to the combined sewer system. Testing and analysis of water is required to verify that discharge quality criteria are met.
   2. Surface water control system.
      a. The extracted groundwater from the excavations shall be contained in a portable storage tank prior to discharging to the combined sewer system.
   3. System operation and maintenance.
      a. A backup pump shall be available at all times in the event the primary pump becomes inoperable.
   4. Water disposal.
      a. The de-silted groundwater shall be discharged to the CCSF (PUC) combined sewer system, provided the quality of the water as evidenced by testing and analysis is acceptable to CCSF (PUC). The Contractor is responsible to obtain the necessary permits from CCSF (PUC) and any other regulatory agency.

B. Related Sections:
   1. Division 1 – General Requirements
   2. Section 02250 – Shoring and Trench Safety
   3. Section 02200 – Earthwork

1.2 DEFINITIONS

A. Dewatering includes the following:
   1. Removal of ground water and horizontal water seepage accumulating in the excavations.
   2. Disposal of removed water. Extracted groundwater from the excavation shall be de-silted and discharged to the local combined sewer under an approved permit obtained by the Contractor and issued by CCSF (PUC).

B. Design dewatering systems to:
   1. Remove groundwater within the excavation to permit Work to be completed.
   2. Provide groundwater pumping from the excavation to maintain minimal groundwater accumulation.
   3. Maintain stability of sides and bottoms of excavations.

C. Design surface water control systems to:

1. Collect extracted groundwater and seepage entering excavations and provide temporary storage and de-silting prior to discharge. Discharge from the temporary storage tank(s) shall be directed through a particulate/sediment filter, then a flow totalizer prior to discharge at the combined sewer system.

1.3 SUBMITTALS

A. Section 01330, "Submittal Procedures," requirements for submittals.

B. Dewatering Plan: Signed and sealed by professional engineer.
1. Prepare a dewatering plan and submit to the Engineer for approval prior to implementation. This plan shall be submitted a minimum of two weeks before the groundwater extraction begins.
2. Indicate dewatering system layout, extraction depths, screen lengths if applicable, dewatering pump locations, pipe sizes and capacities, grades, proposed water quality testing and analysis methodology and frequency, particulate/sediment filter specifications, surface water control devices such as valves, totalizers, and water disposal method and location.
3. If applicable, indicate primary and standby power system location and capacity. If pumps operate by fuel, indicate location, storage and amount of fuel contained at the site.
4. Include detailed description of dewatering and monitoring system installation procedures and maintenance of equipment.
5. Include description of emergency procedures to follow when problems arise.
6. Groundwater may be present in trench backfill of existing utilities. Contractor shall design shoring and dewatering systems to mitigate against washout of materials from existing utility trenches. The design of this system shall be submitted to the engineer for acceptance. Reconstruction of the structural section of any road shall be completed at the Contractor's expense.

C. Product Data: Submit data for each of the following:
1. Dewatering Pumps: Indicate sizes, capacities, priming method, engine or motor characteristics.
2. Pumping equipment for control of surface water within excavation.
3. Pumping equipment for control of discharge to combined sewer.
4. Size of temporary storage tank(s).
5. Specifications and size of particulate filter for meeting discharge requirements.
6. Totalizer size and discharge to combined sewer.

D. Design Data: Signed and sealed by California registered professional engineer.
1. Indicate design values, analyses, and calculations to support design.
2. Indicate the monitoring system to maintain and control the excavation dewatering.
3. Include the system to initially dewater the excavation and the system to maintain the excavation dewatering during the construction process.

E. Traffic Control Plan:
1. Provide traffic control plans around tanks, hoses and other dewatering equipment per Contract Documents.

1.4 CLOSEOUT SUBMITTALS

A. Section 01330, “Submittal Procedures,” requirements for submittals.

B. Provide a document of the total amount of groundwater extracted and discharged to the CCSF (PUC) combined sewer system.

1.5 QUALITY ASSURANCE

A. If wells are used, obtain a drilling permit from CCSF (PUC).

B. Obtain permit from CCSF (PUC) and/or the Regional Water Quality Control Board (RWQCB) for the extracted groundwater discharge to the combined sewer system or percolation basin. Comply with all sampling, testing and analysis, discharge flow and daily volume requirements.

C. Perform Work in accordance with State, CCSF (PUC), RWQCB, and the California Building Code requirements.

D. Maintain one copy of the permit documents on site.

1.6 QUALIFICATIONS

A. Design, install, and monitor operation of dewatering under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of California.

1.7 PRE-INSTALLATION MEETINGS

A. Section 01200, “Project Meetings,” Pre-installation meeting required.

B. Convene minimum two weeks prior to commencing work of this section.

1.8 SEQUENCING

A. Section 01310, “Progress Schedules,” Coordinate dewatering with other project activities.

B. Sequence work to obtain required permits before start of dewatering operations.

C. Sequence work to install dewatering and surface water control systems a minimum of 7 days before starting excavation.

1.9 COORDINATION

A. Coordinate work to permit the following construction operations to be completed on stable substrate.
   1. Excavation for structures specified in Section 02200, “Earthwork.”

B. Coordinate with CCSF (PUC) and RWQCB prior to any groundwater discharge to the combined sewer system.

C. Coordinate with the Engineer of Record prior to the commencement of any soil excavation and groundwater discharge.

D. Coordinate with CCSF (PUC) and RWQCB for removal of any dewatering wells.

E. Contractor must apply for a Wastewater Batch Discharge Permit from SFPUC WWE/CSD prior to any discharge to the city's sewer system.

PART 2 - PRODUCTS

2.1 DEWATERING EQUIPMENT

A. Select dewatering equipment to meet specified performance requirements.
   1. The equipment shall include but not limited to: extraction pumps and backups, storage/surge tank, transfer pump, particulate/sediment filter housing and replacement filters, flow totalizer, miscellaneous hoses, fittings and connectors to hook up, operate and maintain the dewatering process.

2.2 MONITORING EQUIPMENT

A. Flow Measurement: Furnish devices as follows:
   1. Install and monitor a flow totalizer for the discharged volume and rate of flow to the CCSF (PUC) combined sewer system.
   2. Monitor the flow rate and pressure within the particulate/sediment filter, replace filters as necessary to maintain a sediment free flow.
   3. Install and monitor the groundwater accumulation within the excavation and control the extraction of the groundwater to maintain a water free work conditions.

B. Groundwater must be tested and analyzed for turbidity and hazardous constituents prior to discharge per requirements of PUC. Provide equipment necessary to comply.

2.3 ACCESSORIES

A. Valves and Fittings: Furnish valves, fittings and backflow prevention to isolate each extraction well from header pipe that discharges to the storage tank and to prevent loss of pump prime. Provide valves, fitting and backflow prevention devices for the discharging of extracted groundwater to the combined sewer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work and notify Owner and Engineer fo Record of any discrepancies discovered.

B. Contact CCSF (PUC) not less than seven working days before any discharge of groundwater to the combined sewer.

1. Conduct all groundwater discharge work, testing and analysis in accordance with CCSF (PUC) and/or RWQCB requirements and as specified in the permit.

3.2 PREPARATION

A. Provide necessary protection from any damage caused by dewatering operations in the event of a system failure.

3.3 DEWATERING SYSTEM

A. The system shall be designed to coexist with the excavation activities. The sidewalls of the excavations shall be shored. The dewatering system will be required to remove all groundwater from the planned excavations to enable the planned work to be completed.

B. Install dewatering system in accordance with the approved dewatering system design.

C. Locate system components to allow continuous dewatering operations without interfering with the excavation Work and existing public rights-of-way, sidewalks and improvements.

D. Install the dewatering system in accordance with State, CCSF (PUC), and RWQCB standards and requirements.

3.4 SURFACE WATER CONTROL SYSTEM

A. Contain all extracted groundwater in temporary storage tank(s) prior to discharge to the combined sewer.

B. Control the flow rate of discharged groundwater to the sewer manhole, maintaining the particulate/sediment filter and monitoring the totalizer to record the flow rate and volume.

C. Control and remove all unanticipated water seepage into excavation.

D. All pumps, piping, hoses and storage tanks shall be correctly designed so that no releases of extracted groundwater will occur during the dewatering and construction activities.

3.5 SYSTEM OPERATION AND MAINTENANCE

A. Operate dewatering system continuously until all structures are installed and until backfilling has progressed to a significant height to anchor the work against possible floatation or leakage. It is anticipated due to shallow groundwater that the dewatering activities will continue until all of the backfill has been placed.

B. Provide supervision of dewatering system by personnel skilled in operation, maintenance, and replacement of system components.

C. Conduct daily observation of dewatering system and monitoring system. Make required repairs and perform scheduled maintenance.

D. Fill fuel tanks before tanks drop to 25 percent capacity.

E. Start emergency generators (if applicable) at least twice each week to check operating condition.

F. When the dewatering system cannot control water within excavation, notify Engineer of Record and stop excavation work.
   1. Supplement or modify dewatering system and provide other remedial measures to control water within excavation.
   2. Demonstrate dewatering system operation complies with performance requirements before resuming excavation operations.

G. Modify dewatering and surface water control systems when operation causes or threatens to cause damage to new construction, existing site improvements, adjacent property, or personal health.

H. Correct unanticipated pressure conditions affecting dewatering system performance.

I. Do not discontinue dewatering operations without Engineer of Record's approval.
   1. The dewatering system shall be operated during the excavation activities and shall maintain a water free work place within the excavation for work to be completed. The discharge of groundwater to the combined sewer shall be monitored throughout the construction process and shall not exceed the flow rate established by CCSF (PUC) and in accordance with the appropriate permit requirements. The dewatering equipment shall be maintained so that no lapse in operation will occur until backfilling is complete. Inspections of the equipment shall be made through each day and through the duration of the project. All equipment in need of repair or in question shall be repaired, replaced or conditions corrected immediately.

3.6 WATER DISPOSAL

A. Discharge water into Contractor-supplied storage tank(s) prior to the combined sewer system.

B. Discharge from storage tank can be either through gravity or by pressure by maintaining a transfer pump. The discharge must be directed through a particulate/sediment filter and a flow totalizer prior to discharge.

C. All groundwater must be discharged to the combined sewer under an approved permit from CCSF (PUC). Appropriate permits and adherence to the requirements of the discharge permits will be strictly enforced.

3.7 SYSTEM REMOVAL

A. Remove dewatering and surface water control systems after dewatering operations are discontinued.

B. Repair damage caused by dewatering and surface water control systems or resulting from failure of systems to protect property.

C. Once the storage tank(s) are no longer needed, clean and remove from the site and return the area to original condition.

3.8 FIELD QUALITY CONTROL

A. Allow for Owner and CCSF (PUC) representatives to field inspect system periodically to ensure system workability, public safety and design controls are met.

B. Monitor and record the following daily.
1. Average discharge flow rate to the combined sewer system.
2. Total discharged volume to the combined sewer system.
3. Total extracted from the excavation to the storage/surge tank.

C. Monitor particulate/sediment filter for solids content. Replace filters as necessary to ensure sediment free discharge to the combined sewer system.

D. Submit required monitoring reports including the following:
1. Dewatering flow rates and total volume discharged to the CCSF (PUC) combined sewer system.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.0 REFERENCE STANDARDS AND DOCUMENTS

A. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), Latest Edition, also referred to as "City Standard Specifications."

B. Standard Plans of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SPDPWSF), Latest Edition, also referred to as "City Standard Plans."

C. Department of Public Works (DPW) Order No. 178,940 "Regulations for Excavating and Restoring Streets in San Francisco".

D. ENGEO, "Geotechnical Investigation, New Artist Building, Hunters Point Shipyard," December 13, 2013

E. Project specific Geotechnical Evaluation, prepared by the project Geotechnical Engineer.

F. California Occupations of Safety and Health (Cal/OSHA)

G. California State Labor Code

H. California State Health and Safety Code

I. Uniform Building Code (UBC)

J. California Building Code (CBC)

K. Caltrans Standard Specifications, Latest Edition

1.1 SUMMARY

A. Section includes (but is not necessarily limited to) preparation of subgrade zones to the lines and grades indicated on the Drawings and as described herein.

B. Proper means of safety are to be practiced during these operations including, but not limited to, worker safety, utility locating, and dust control.

C. Upon completion and acceptance by the Owner's Agent of demolition, earthwork operations may proceed.

D. Geotechnical

1. Preparing and grading subgrades for building pads, ramps, slabs-on-grade, walks, pavements, and landscaping.

2. Excavating and backfilling for new foundations, structures, and utilities.

3. Placing and compacting subbase course for walks and pavements.

4. Placing and compacting utility trench backfill.

5. Preventing dust.

6. Staking and Layout.

1.2 RELATED SECTIONS

A. Section 02050, “Demolition”.

B. Section 02200-1, “Prefabricated Vertical Drain Specification”.

C. Section 02225, “Excavation, Backfilling and Compacting for Utilities”.

D. Section 02720, “Specialty Sidewalks”.

E. Section 02740, “Asphalt Concrete Pavement”.

F. Section 03300, “Cast-in-Place Concrete”.

1.3 DEFINITIONS

A. Backfill: Material used in refilling a cut, trench, holes, or other excavations.

B. Base Course: The layer placed between the subbase or subgrade and surface pavement in a paving system. See Section 02200-2.1 D for base material.

C. Bay Mud: A local marine deposit, which is typically classified as CH, MH, or OH.

D. Capillary Break: Course of washed granular material beneath a slab-on-grade (topping/floor slab) placed to minimize upward capillary flow of pore water.

E. Compaction: The process of mechanically placing a material at a controlled density and moisture condition. “Degree of Compaction” or “Relative Compaction” is expressed as a percentage of the maximum density obtained by the test procedure described in ASTM D1557 abbreviated in this Specification, for example, as “90 percent ASTM D1557 maximum density.”

F. Cut: Removal of soil to obtain a specified soil elevation.

G. Engineered Fill: Engineered fill is suitable material placed to required lines, grades and compaction requirements as set forth within the Contract Documents.

H. Excavation: Removal of soil to obtain a specified depth or elevation. All excavation shall be considered unclassified, regardless of type, nature, or condition of materials encountered. Contractor shall make his own estimate of kind, suitability and extent of various materials to be excavated for this project.

I. Import Borrow: Soil material obtained from off-site when sufficient approved soil materials not available from on-site.

J. Lift: Horizontal layer or course of soil placed on top of previously prepared, compacted or placed soil, or subgrade.

K. Optimum Moisture Content: Optimum moisture content shall be determined in accordance with ASTM D1557.

L. Overexcavation: Overexcavation is excavation beyond the limits designated in the Contract Documents. When overexcavation is ordered by the Owner's Agent (Geotech), then excavation and backfill will be paid for as an item of extra work. When overexcavation is not ordered by the Owner's Agent (Geotech), then excavation and backfill shall be performed by the Contractor at no additional cost to the Owner.

M. Rock: Any in place natural soil or material which cannot be excavated with conventional earth moving equipment and requires use of special buckets, rock teeth, jack-hammering, and/or other special methods of excavation.

N. Rubble: Any man made material or debris, construction spoils or rock fill exceeding 3-inches in greatest dimensions.

O. Shoring: A combination of bracing, plates, walls, boxes, anchors, etc. used to maintain a safe and stable excavation during construction. Typical shoring systems are designed to allow no more than one inch of movement laterally.

P. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

Q. Subbase Course: The layer placed between the subgrade and base course in a paving system or the layer placed between the subgrade and surface of a pavement or walk. See Section 02200-2.1 E for subbase material.

R. Subgrade: The uppermost soil surface upon which future pavement, base material, fill material, or structural foundation will be placed.

S. Suitable Material: See satisfactory soil materials Section 02200-2.1 B.

T. Unauthorized excavation: removal of materials beyond indicated subgrade elevations or dimensions without approval of Owner’s Agent (Geotech).

U. Unclassified Excavation: Unclassified excavation means that the nature of materials to be encountered has not been identified or described within these Specifications.

V. Unsuitable Material: Existing, in-place soil or other material designated by the soils reports or Owner's Agent (Geotech) as having insufficient strength characteristics or stability to carry intended loads without excessive consolidation or loss of stability. As a minimum, materials classified as MH, CH, OL, OH and PT by ASTM 2487 are unsuitable. Also, material designated by the Environmental Engineer or material containing rock or rubble greater than three inches in size, refuse, organic material, and/or any other material which could hinder compaction shall be considered unsuitable. Material shall not be classified as unsuitable solely on the basis of moisture content not being within specified limits.

W. Utilities: underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

X. Weathered Rock: Any in-place native soil or material that was previously rock but is weathered such that it can be excavated with conventional equipment.

1.4 SHEETING, SHORING, AND BRACING

A. For all excavation greater than five (5) feet in depth, Contractor shall design, maintain and install sheeting, shoring and/or bracing, Sheeting, shoring and/or bracing plan shall be designed by a California Registered Engineer and installed per regulatory requirements of Cal/OSHA, California State Labor Code and CBC. Design shall take into account Project soils, seismic requirements and other constraints.

B. All excavation in Bay Mud shall be shored.

1.5 QUALITY ASSURANCE

A. Contractor shall verify shrinkage characteristics of all soils to be used on the site as engineered fill. The Owner will not be responsible for additional costs associated with variations in shrinkage or bulking factors and related earthwork quantities.

B. Samples of proposed fill shall be provided to the Owner’s Agent (Geotech) at least 72 hours prior to its use. It shall not be used as fill or backfill until it is approved.

C. All testing required by this Section and other Sections of these Specifications shall be performed by an independent, qualified Testing Company as approved by Owner. Retesting required as a result of failed tests shall be at the Contractor’s expense.

D. Codes and Standards: Perform earthwork complying with the requirements of Design Geotechnical Report, dated January 19, 2015, and authorities having jurisdiction.

E. Testing and Inspection Service: The owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to check that the soils are suitable for use as engineered fill and to perform required field and laboratory testing to check required compaction and moisture requirements. Samples of proposed engineered fill shall be provided to the geotechnical engineer at least 72 hours prior to its use. It shall not be used as fill or backfill until it is approved.

E. Contractor shall submit laboratory certification that any manufactured material to be used complies with the requirements given in the specifications.

F. The geotechnical engineer may request or collect samples of material to check conformance during construction.

G. Contractor shall employ a surveyor to confirm dimensions, locations, and elevations.

H. A corrosion consultant has been retained by the Owner or Owner's Agent to evaluate the corrosivity of the soil and recommend appropriate mitigation measures.

1.6 TOLERANCES

A. Earthwork shall be constructed within a vertical tolerance of +/-0.1 foot, unless otherwise shown. Grading shall be executed to maintain slopes and drainage as indicated. Variations within the specified tolerance shall be compensated so that the average grade and cross section specified are met.

1.7 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTIES AND SERVICE

A. See requirements specified in Section 02050, "Demolition."

B. If Contractor encounters live utilities not indicated, protect the same from damage and immediately notify the Owner's Agent and the affected utility provider. Do not proceed until further instructions are received from the Owner's Agent.

1.8 EQUIPMENT

A. Contractor shall ensure that all equipment used on this site is operated, inspected and maintained in accordance with applicable Cal/OSHA standards.

1.9 LAND MONUMENTS

A. Contractor shall notify the Owner's Agent of any existing federal, state, county, and private land monuments encountered. Owner will make arrangements to have monuments "tied-out" and replaced and/or relocated. Monuments destroyed by Contractor, which were not previously shown to the Owner's Agent, shall be replaced at Contractors expense.

B. Survey monuments disturbed by the Contractor shall be reset under the supervision of a professional land surveyor or professional civil engineer who is authorized to practice land surveying. In addition, a certificate of correction or corner record shall be filed as appropriate.

1.10 HAZARDOUS MATERIALS

A. Trench and structure excavations have been designated as California Hazardous Waste. See Section 02050, "Demolition" for requirements if, during the course of the work of this Section, Contractor encounters any surface or subsurface materials other than conditions previously noted and that Contractor believes are hazardous (as defined in Section 25117 of the Health and Safety Code).

B. Native soil, in areas outside the Right-of-Way, to receive fill, shall be overlain by a Native Soil Marker Fabric prior to placing fill.

1.11 SUBMITTALS

A. Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Test Reports: Contractor shall submit the following:

1. Geotechnical and environmental laboratory analysis of each soil material proposed for engineered fill and backfill from on-site and off-site borrow sources. Soil material imported from offsite sources must be accompanied by environmental laboratory analysis for review by Owner's Agent prior delivery of such soils.
2. One optimum moisture-maximum density curve for each soil material.

C. Contractor shall submit any samples of soil proposed for use as engineered fill at least 72 hours prior to use as engineered fill. Substitutions: submit in writing to Owner's Agent prior to use. Substitutions may not be allowed per other sections of these specifications.

D. Contractor shall submit certifications of manufactured materials at least 72 hours prior to use.

E. Laboratory tests on materials shall have been performed less than 3 months prior to submittal.

F. Submit Sheeting, Shoring and Bracing Plan, as specified in paragraph 1.4 A.

1.12 PROJECT CONDITIONS

A. Contractor shall visit the site to determine if the existing conditions, nature of materials to be encountered, and all other facts concerning or affecting the work.

B. Contractor should submit in writing, any questions or comments regarding discrepancy or constructability between the specs, the plans and existing conditions before bidding.

C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.

1. Provide a minimum 72-hours notice to the Owner and receive written notice to proceed before interrupting any utility.

D. Existing Foundations: See Section 02050, "Demolition."

E. Any water and debris which would interfere with construction shall be removed from excavated areas. Excavations shall be free from loose material and water while forms are being set and concrete placed. During rainy weather, maintain excavations free of water by pumping and other appropriate means. Pumping from excavations shall be performed in such a manner as to preclude the possibility of any portion of the concrete being carried away. All water resulting from dewatering operations shall be disposed of in accordance with the requirements of the City and County of San Francisco and/or the San Francisco Bay Regional Water Quality Control Board.

F. Throughout the entire construction period, keep dust down within the working area along roads used in the operations and all involved portions of site by intermittent watering and sprinkling. In accordance with Bay Area Air Quality Management District (BAAQMD) guidelines, unpaved access roads should be watered three times daily and other active construction areas twice daily. If necessary, all areas should be watered more frequently to prevent visible dust plumes from migrating outside of the development parcel.

G. Contractor shall keep his work area clean, and in a safe and workmanlike condition so that rubbish, waste and debris do not interfere with the work of other trades.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.

B. Satisfactory Soil Materials: ASTM D-2487 soil classification groups GW, GP, GM, GC, SW, SP, SC and SM; free of rock or gravel larger than 4 inches in greatest dimension, debris, waste, frozen materials, vegetation and other deleterious matter. Other soil classifications shall be submitted to the project geotechnical engineer for approval before being used as backfill. The soil materials shall be 100 percent passing 3-inch sieve, a range of 35-100 percent passing No. 4 sieve size, and a range of 20-100 percent passing No. 30 sieve size. Satisfactory soil shall have a liquid limit less than 40 and a plasticity index lower than 12.

C. Backfill and Engineered Fill Materials: Satisfactory soil materials.

D. Aggregate Base Material: Conform to Section 205 of the City Standard Specifications. Reclaimed materials may be incorporated in accordance with Caltrans Standard Specifications, 26-1.02A & B.

E. Aggregate Subbase Material: Shall conform to Caltrans Standard Specifications Section 25-1.02.

F. Engineered Fill: Satisfactory soil material, subbase, or base materials.

G. Crushed Rock: Washed, evenly graded mixture of crushed stone, or crushed gravel, with 100 percent passing a 1-inch sieve, 90 to 100 percent passing a 3/4-inch sieve and not more than 5 percent passing the No. 4 sieve. Recycled Materials shall not be allowed in Crushed Rock.

H. Capillary Break: clean, washed, free-draining, open-graded gravel, or crushed rock. Gradation Requirements for Capillary Break:

Sieve Size	Percentage Passing Sieve
1 inch	90-100
3/4 inch	30-100
1/2 inch	5-25
3/8 inch	0-6

I. Pipe Bedding Material: See Section 02225.

J. Stabilization Material: Crushed Rock or Recycled Material meeting the gradation of Crushed Rock. A stabilization fabric may be required.

K. Clay Plug: Shall consist of soil material which has permeability less than 10-6 cm/sec at 85% Relative Compaction. Material may be CL or CH or other soil material modified with additives to accomplish required permeability.

2.2 GEOTEXTILES

A.	Stabilization Reinforcement Fabric:	Mirafi 600X or approved equivalent
B.	Filter Fabric:	Mirafi 140NC or approved equivalent
C.	Erosion Control Fabric:	(See Special Provisions)
D.	Native Soil Marker Fabric:	Mirafi SAF, Tenax Guardian, or equiv., Orange

2.3 COMPACTION EQUIPMENT

A. Compaction equipment shall be of suitable type, adequate to obtain satisfactory breakdown of materials and specified densities to form a dense fill.

B. Compaction equipment shall be operated in accordance with the manufacturer's instructions and recommendations. Equipment shall be maintained to deliver manufacturer's rated comparative effort. If inadequate densities are obtained, larger and/or different types of additional equipment capable of achieving specified densities shall be used.

C. Vibratory equipment: See Paragraph 3.12E.

2.4 MOISTURE CONTROL EQUIPMENT

A. Equipment for applying water shall be of a type and quality which is adequate for the work, does not leak, and is equipped with a distributor bar or other approved device to assure uniform application. Equipment for mixing and drying materials shall consist of blades, discs or other equipment.

PART 3 - EXECUTION

3.1 GENERAL

A. Material Handling

1. Excavated soil shall be stockpiled at a site within Candlestick Point / Hunter's Point designated by the Owner's Agent.

2. Material determined to be unsuitable material by the Owner's Agent shall be stockpiled separately from suitable material.

3. All suitable excavated material shall be screened via double racks (screening in two directions) to remove all material or debris three (3) inches and larger in the greatest dimension.

4. Oversized materials and/or debris removed from the suitable soil by screening shall be placed in the stockpile of unsuitable material.

5. All suitable material passing the 3-inch sieve, to the extent feasible, shall be mixed with appropriate import backfill sand to obtain 100 percent passing 3-inch sieve, a range of 35-100 percent passing No. 4 sieve size, and a range of 20-100 percent passing No. 30 sieve size for use in the work or delivered to another location within Candlestick Point / Hunter's Point designated by the Owner's Agent.

6. At such time as earthwork (and trenching) operations are substantially complete and it is determined that there is excess suitable material, the excess suitable material shall be added to the stockpile of unsuitable material. The unsuitable material stockpile will then be tested by the Owner's Agent to determine the classification for off haul purposes. Once the stockpile is tested, no new material shall be added to, or removed from, the stockpile. If the suitable or unsuitable material is to remain on a Candlestick Point / Hunter's Point parcel for more than 30 days, Contractor is required to cover the stockpile.

7. Contractor shall be responsible for off-site disposal of all excess material and shall, for bidding purposes, assume all excess material to be Class II materials. Owner's Agent will direct the Contractor where the excess material is to be shipped/disposed based on the results of the testing conducted in (6). Contractor is responsible for preparing and managing any necessary shipping and disposal documents (bills of lading, non-hazardous waste manifests, hazardous waste manifests, weight tags from the landfill, etc.). All shipping and disposal documents are to be delivered to Owner or Owner's Agent at the conclusion of shipping and disposal efforts.

8. Materials determined to be non-Class II materials shall be disposed of accordingly and changes in cost will be negotiated with the Contractor. Imported sand for the purpose of mixing with suitable materials will be excluded from the negotiated cost. The Contractor shall be responsible for the cost of disposal of any imported sand.

B. All soil excavated from within the Candlestick Point / Hunter's Point Project Area and transported along public streets (also within the Candlestick Point / Hunter's Point Project Area) must be done so by fully licensed hazardous waste haulers and transportation companies and in full compliance with the Hazardous Waste Manifest Variance issued by the California Department of Toxic Substances Control and as provided by Owner's Agent.

C. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 GRADING

A. Work to be performed shall be relative to finished grades shown on the Drawings. Earthwork beneath proposed paved areas is to be constructed to pavement subgrade (finished pavement surface grade minus the thickness of the proposed structural section).

B. If site grading occurs when onsite soils are above the optimum moisture content, aeration, blending, or chemical treatment with lime and/or cement may be used to reduce the moisture content to within specified limits.

3.3 EXCAVATION

A. Explosives: Do not use explosives.

B. Unclassified Excavation: Excavation is unclassified and includes excavation to required sub grade elevations regardless of the character of materials and obstruction encountered.

C. Soft or wet materials encountered at excavation subgrade shall be removed and replaced with lean concrete, engineered fill, crushed rock, stabilization material, or cement-treated soil, as approved by the Owner's Agent (Representative of Geotechnical Engineer) to provide non-yielding subgrade. In soft soil conditions, a stabilization reinforcement fabric may be placed as needed prior to placement of these materials. Where open-graded crushed rock or stabilization material is used, it shall be covered entirely by filter fabric.

3.4 STABILITY OF EXCAVATIONS

A. For all excavations Contractor shall design, maintain and install sheeting, shoring and/or bracing per regulatory requirements of Cal/OSHA, California State Labor Code, CBC. Design shall take into account Project soils, seismic requirements and other constraints.

B. All excavations in Bay Mud shall be shored.

C. When Bay Mud or soft, wet soil is encountered at the bottom of an excavation, a stabilization reinforcement fabric shall be placed and overlain by at least 12 inches or more of stabilization material as needed to provide a non-yielding subgrade and covered entirely by filter fabric (Mirafi 140 NC), unless greater measures are specified in the plans or as directed by the Owner's Agent (Representative of Geotechnical Engineer).

D. See geotechnical report for temporary excavation slopes.

E. Comply with the geotechnical report, local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

F. Excavations shall be supported and braced to prevent movement of the adjacent soil. Shoring and bracing systems shall be designed by a Civil Engineer registered in the State of California. Drawings and Calculations for shoring shall be submitted for review by the Owner's Agent.

G. Dewatering shall be performed if excavations are anticipated to extend below the groundwater table. Groundwater table shall be maintained a minimum of 3 feet below the bottom of excavation until backfill is completed.

3.5 EXCAVATION OF STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.10 foot. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections.

B. Prior to placement of any concrete (either lean concrete or structural concrete), the soil at the exposed subgrade shall be rolled to produce a smooth, non-yielding surface.

C. Soft or wet materials encountered at excavation subgrade shall be removed and replaced with lean concrete, engineered fill, crushed rock, stabilization material, or cement-treated soil, as approved by the Owner's Agent (Representative of Geotechnical Engineer) to provide non-yielding subgrade. In soft soil conditions, a stabilization reinforcement fabric may be placed as needed prior to placement of these materials. Where open-graded crushed rock or stabilization material is used, it shall be covered entirely by filter fabric.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

B. Prior to placement of any concrete, pavers, or pavement, the soil at the exposed subgrade shall be conditioned to produce a smooth, non-yielding surface.

C. Soft or wet materials encountered at excavation subgrade shall be removed and replaced with lean concrete, engineered fill, crushed rock, stabilization material, or cement-treated soil, as approved by the Owner's Agent (Representative of Geotechnical Engineer) to provide non-yielding subgrade. In soft soil conditions, a stabilization reinforcement fabric may be placed as needed prior to placement of these materials. Where open-graded crushed rock or stabilization material is used, it shall be covered entirely by filter fabric.

3.7 APPROVAL OF SUBGRADE

A. Notify the Owner's Agent (Representative of Geotechnical Engineer) 48 hours prior to excavations reaching required subgrade.

B. When the Owner's Agent (Representative of Geotechnical Engineer) determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or lean concrete as directed.
   1. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in Work.

C. Reconstruct subgrades damaged by sun, rain, accumulated water, or construction.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill shall be used to bring elevations to proper position when acceptable to the Owner's Agent.

B. Fill unauthorized excavations under other construction as directed by the Owner's Agent.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.

   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of existing trees.

   2. For soil stockpiles in place for less than 30 days, cover, enclose, water twice daily, or apply non-toxic soil binders.

   3. For soil stockpiles in place for more than 30 days, cover with anchored plastic sheeting or hydro seed.

   4. For soil stockpiles in place for one year or greater, the stockpiles must be hydro seeded or similarly covered.

   5. During the rainy season, all stockpiles must be covered with anchored plastic sheeting, hydro seeding, or another equivalent cover.

B. Remove excess excavated material from site immediately. Prior to deposing of soils offsite, Owner approval must be granted.

3.10 BACKFILL AND FILL AREAS

A. The Contractor shall notify the Owner's Agent (Representative of Geotechnical Engineer) at least 48 hours prior to commencing each phase of earthwork.

B. Preparation: Remove vegetation, topsoil, pavement, debris, wet, and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.

C. When subgrade or existing ground surface is to receive fill, scarify subgrade surface to depth of 8 inches, pulverize, moisture-condition or aerate soil to optimum moisture content and compact to required relative compaction per recommendations provided in the Geotechnical report.

D. All soil to be used as backfill and engineered fill should be prepared such that it meets the requirements of suitable soil material before placement. Preparation includes but is not limited to screening the soil to filter out all material larger than 3-inches in greatest dimension, and removing any material previously discussed under the definition of unsuitable soil material. Furthermore, the soil should be moisture conditioned to near optimum moisture content prior to placement.

E. Backfill excavations promptly, but not before completing the following:

1. Acceptance of construction below finish grade.

2. Concrete formwork removal.

3. Removal of trash and debris from excavation.

4. Removal of temporary shoring and bracing, and sheeting.

F. Place fill material in layers to required elevations for each location listed below.

1. Under walks and pavements, use subbase or base material, or satisfactory excavated or borrow soil material.

2. Under steps and ramps, use subbase material.

3. Under footings and foundations, use engineered fill.

G. Where open-graded rock is used as backfill, bedding, cover, and/or stabilization material, it shall be entirely covered by a filter fabric, Mirafi 140 NC or equivalent.

3.11 OVEREXCAVATION AND BACKFILL

A. Where indicated on the Project Drawings and directed by the Owner's Agent (Geotechnical Engineer) or CCSF BCM (City Inspection Agency), commence with overexcavation in areas where the required fill depth is less than two feet thick below subgrade for roadways or in areas where subgrade is in unsuitable conditions. "Zone 1 Overexcavation and Backfill" and "Zone 2 Overexcavation and Backfill within the property line" are identified as stages of work required for this item.

1. Zone 1 Overexcavation and Backfill: the Contractor shall overexcavate one-foot deep to the horizontal dimensions specified. If poor soils have been excavated to the satisfaction of the Owner's Agent, the exposed surface shall be scarified eight inches deep and recompacted. The overexcavation shall be backfilled with engineered fill to subgrade level. Measurement shall be on a square yard basis and payment shall include full compensation for labor and materials, including processing of excavated material or replacement thereof to conform to requirements of engineered fill.

   Zone 2 Overexcavation and Backfill: At the completion of overexcavation of Zone 1 and as directed by the Owner's Agent, the Contractor shall overexcavate one-foot deep below to the horizontal dimensions specified. The exposed surface shall be scarified eight inches deep and recompacted. The overexcavation shall be backfilled with engineered fill to subgrade level. Measurement shall be on a square yard basis and payment shall include full compensation for labor and materials, including processing of excavated material or replacement thereof to conform to requirements of engineered fill.

3.12 COMPACTION

A. Place backfill and fill materials in layers not more than 8 inches in loose lifts.

B. Place backfill and fill materials on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.

C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages relative compaction according to ASTM D 1557:

1. Under pile-supported structures, compact to 90 percent relative compaction.

2. Under non-pile-supported structures and slabs-on-grade, compact the top 12 inches below subgrade and each layer of backfill or fill material to 95 percent relative compaction. Where less than 6" of new fill is to be placed, overexcavate and recompact to depth needed to provide 12 inches of compacted soil below subgrade.

3. Under city streets, from back of curb to back of curb, compact the subgrade soil within the upper 36 inches of finished roadway surface to 95 percent relative compaction.

4. Under city sidewalks, which are not otherwise referred to as specialty sidewalks, compact fill to 90 percent relative compaction, compact the upper 6 inches of subgrade to minimum 95 percent relative compaction. Where sidewalk occurs over structural soil planting trench, refer to Specification Section 02920 for compaction requirements.

5. Under Speciality Sidewalks, compact upper six inches below subgrade to 95 percent relative compaction.

6. Below the specified depths (items 1 through 4 above) backfill or fill material at least 90 percent relative compaction.

D. Jetting shall not be permitted.

E. Vibratory equipment shall not be used where shallow groundwater is present that when vibrated will adversely affect compaction efforts. The contractor shall repair any subgrade/fill damaged by the use of vibratory equipment at no cost to the owner.

F. Where lightweight fill material is used, cover lightweight fill material with stabilization reinforcement fabric. Stabilization reinforcement material fabric such as Mirafi 600X or approved equal shall also be placed between lightweight fill and aggregate base or aggregate subbase.

G. Lightweight Fill Requirements:

1. Lightweight fill (cellular concrete) shall be placed in lifts of less than 3 feet. Subsequent lifts shall be placed once the initial lift has cured as directed by the manufacturer.

H. The subgrade beneath pavements and sidewalks shall be compacted to provide a smooth non-yielding surface. Subgrade shall be proof-rolled under the observation of the geotechnical engineer.

3.13 SUBBASE AND BASE COURSES

A. Under pavements and walks, place subbase course material on prepared subgrades. Place base course material over subbases to pavements. Both the subbase and base materials shall be placed and compacted to a minimum 95 percent relative compaction as defined by ASTM D1557. Where sidewalk occurs over structural soil planting trench, refer to Specification Section 02920 for compaction requirements.

3.14 FIELD QUALITY CONTROL

A. Testing Agency Services: The Owner's Agent (Representative of Geotechnical Engineer) will test each subgrade and each fill or backfill layer. Contractor shall not proceed until test results for previously complete work verify compliance with requirements.

B. Whenever acceptance by the Owner's Agent (Representative of Geotechnical Engineer) is required by these Specifications, the Contractor shall notify the Owner's Agent (Representative of Geotechnical Engineer) at least 48 hours prior to commencing any phase of earthwork.

1. No phase of the work shall proceed until the prior phase of work has been accepted by the Owner's Agent (Geotech).

2. Work shall not be covered up or continued until acceptance of the Owner's Agent (Representative of Geotechnical Engineer) has been obtained.

3. The Owner's Agent (Representative of Geotechnical Engineer) will give written notice of conformance with the geotechnical aspects of the Specifications upon completion of grading.

C. The Owner's Agent (Representative of Geotechnical Engineer) has been retained to observe performance of work under this section.

1. If, in the opinion of the Owner's Agent (Geotech), the work performed does not meet the technical or design requirements stipulated, the Contractor shall make the necessary readjustments as required by the Owner's Agent (Geotech).

2. No deviations from the contract documents shall be made without specific and written acceptance of the Owner's Agent (Geotech).

3. In the event of conflict between the Specifications and the recommendations contained in the Geotechnical Report, the Owner's Agent (Representative of Geotechnical Engineer) shall be notified.

a. The Contractor shall follow clarification and interpretation memoranda prepared by the Owner's Agent (Representative of Geotechnical Engineer) at no additional cost to the Owner.

b. If clarification or interpretation memoranda should result in a change in the scope of work, an adjustment in the contract price will be mutually agreed upon by the Contractor and the Owner.

D. The Owner's Agent review of the Contractor's performance does not include review of the Contractor's safety measures.

3.15 PROTECTION

A. Protecting Excavated Areas: Protect newly excavated areas from traffic, and erosion. Keep free of trash and debris.

B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Owner's Agent. Reshape and recompact optimum moisture content to the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, scarify upper eight inches, moisture condition and recompact subgrade to moisture condition and Relative Compaction per the recommendations in the Geotechnical report, then backfill with additional approved material at required compaction, and reconstruct surfacing, at no cost to the owner.

3.16 ABANDONMENT OF SUBSURFACE UTILITIES

See Section 02050, “Demolition.”

3.17 SAFETY PRECAUTIONS

Contractor shall maintain substantial precautions and other protective measures to safeguard workmen and the general public from bodily injury. As part of standard safety precautions, contractor must prepare an Environmental Health and Safety Plan.

3.18 DEWATERING

A. Prevent surface water and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

C. Remove ponded water immediately.

D. Any repair or recompaction required due to presence of ponded water shall be performed at no cost to Owner.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner’s property as approved in advance by Owner’s Agent.

3.20 HYDRO-MULCHING

A. Following earthwork operations all surfaces of exposed soil (i.e., open-graded areas, detention basins, overflow channels, swales, etc.) shall be hydro-mulched.

3.21 CLAY PLUG

A. Provide and obtain approval of samples of source material. Proposals including mixing on-site materials with bentonite or Portland cement shall be subject to approval of means and methods, and permeability testing by Owner’s Agent at least 72 hours prior to its use. Material shall not be used unless approved by Owner’s Agent.

B. Moisture condition to within 5% of optimum moisture content prior to installation.

C. Place in 8-inch thick uncompacted lifts and compact to at least 85% relative compaction. If Bay Mud is used, the moisture and compaction requirement may be waived provided the Bay Mud is rolled in 12-inch lifts.

END OF SECTION

SECTION 02225

EXCAVATION, BACKFILLING AND COMPACTING FOR UTILTIES

PART 1 – GENERAL

1.0 REFERENCE STANDARDS

A. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), Latest Edition. Also referred to as "City Standard Specifications."

B. Standard Plans of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SPDPWSF), Latest Edition. Also referred to as "City Standard Plans."

C. Department of Public Works (DPW) Order No. 178,940 "Regulations for Excavating and Restoring Streets in San Francisco".

D. ENGEO, "Geotechnical Investigation, New Artist Building, Hunters Point Shipyard," December 13, 2013

E. California Occupational Safety and Health Regulations (Cal/OSHA) – Title 8

F. California State Labor Code

G. California State Health and Safety Code

H. California Building Code (CBC)

1.1 WORK INCLUDED

A. Section includes (but is not necessarily limited to):

1. Work to the lines and grades indicated on the Drawings and as described herein.
2. Excavate, remove and dispose of pavement.
3. Construct, support and maintain all traffic routing and public safety requirements.
4. Construct, support and protect adjoining property and structures.
5. Support and work around existing utilities.
6. Handle all drainage or ground water.
7. Trench excavation and backfill for utility lines
8. Testing
9. Clean the site of the work together with all other work necessary or incidental thereto.
10. Excavation for Pole Foundation.

B. Proper means of safety are to be practiced during these operations including, but not limited to, worker safety and dust control.

C. Upon completion and acceptance by the Owner's Agent (Geotech) of demolition and appropriate earthwork, utility construction may proceed.

1.2 RELATED SECTIONS

1. Section 02050, “Demolition”
2. Section 02200, “Earthwork”
3. Section 02512, “Low Pressure Domestic Water”
4. Section 02513, “Reclaimed Water”
5. Section 02514, “Auxiliary Water Supply System”
6. Section 02535, “Combined Sewer”
7. Section 02536, “Separated Storm Drainage”
8. Section 02537, “Separated Sanitary Sewage”
9. Section 02551, “Natural Gas Distribution”
10. Section 02740, “Asphalt Concrete Pavement”
11. Section 03300, “Cast-In-Place Concrete”

1.3 DEFINITIONS

A. See Section 02200, “Earthwork”.

1.4 SHEETING, SHORING, AND BRACING

A. For all excavations greater than five (5) feet in depth, Contractor shall design, maintain and install sheeting, shoring and/or bracing. Sheeting, shoring and/or bracing plan shall be designed by a California Registered Engineer and installed per regulatory requirements of Cal/OSHA, California State Labor Code and CBC. Design shall take into account Project soils, seismic requirements and other constraints.

B. All excavation in Bay Mud shall be shored.

1.5 QUALITY ASSURANCE

A. Contractor shall verify shrinkage characteristics of all soils to be used on the site as engineered fill. The Owner will not be responsible for additional costs associated with variations in shrinkage or bulking factors and related earthwork quantities.

B. Samples of proposed fill shall be provided to the Owner’s Agent (Geotech) at least 72 hours prior to its use. It shall not be used as fill or backfill until it is approved.

C. All testing required by this Section and other Sections of these Specifications shall be performed by an independent, qualified Testing Company as approved by Owner. Retesting required as a result of failed tests shall be at the Contractor’s expense.

D. Codes and Standards: Perform earthwork complying with requirements of Design Geotechnical Exploration Report, Alice Griffith Housing Redevelopment Infrastructure Improvements, prepared by ENGEO, dated 18 September 2013, and authorities having jurisdiction.

E. Testing and Inspection Service: The owner will employ a qualified independent geotechnical engineering testing agency to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing.

F. Contractor shall employ surveyor to confirm dimensions, locations, and elevations.

1.6 TOLERANCES

A. Earthwork shall be constructed within a vertical tolerance of +/- 0.10 foot, unless otherwise shown. Grading shall be executed to maintain slopes and drainage.

1.7 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTIES AND SERVICE

A. See requirements specified in Section 02050, "Demolition".

B. If Contractor encounters live utilities not indicated, protect the same from damage and immediately notify the Owner's Agent and the affected utility provider. Do not proceed until further instructions are received from the Owner's Agent.

1.8 EQUIPMENT

A. Contractor shall ensure that all equipment used on this site is operated, inspected and maintained in accordance with applicable Cal/OSHA standards.

1.9 LAND MONUMENTS

A. Contractor shall notify the Owner's Agent of any existing federal, state, county, and private land monuments encountered. Owner will make arrangements to have monuments "tied out" and replaced and/or relocated. Monuments destroyed by Contractor, which were not previously shown to the Owner's Agent, shall be replaced at the Contractors expense.

1.10 HAZARDOUS MATERIALS

A. See Section 02050, "Demolition" for requirements associated with encountering any surface or subsurface materials that Contractor believes are hazardous or potentially hazardous (as defined in Section 25117 of the Health and Safety Code).

1.11 SUBMITTALS

A. Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

Test Reports: the Contractor shall submit the following:

1. Geotechnical and environmental laboratory analysis of each soil material proposed for fill and backfill from on-site and borrow sources. Soil material imported from offsite sources must be accompanied by environmental laboratory analysis for review by Geotechnical Engineer prior to delivery of such soils.

B. Contractor shall submit any samples of soil proposed for use as fill at least 72 hours prior to its use as fill. Substitutions: submit in writing to Owner's Agent prior to use. Certain substitutions may not be allowed per other sections of these specifications.

C. Contractor shall submit certifications and samples of manufactured materials at least 72 hours prior to use.

D. Laboratory tests on materials shall have been performed less than 3 months prior to submittal.

E. Submit Sheeting, Shoring and Bracing Plan, as specified in paragraph 1.4 A.

1.12 PROJECT CONDITIONS

A. The Contractor shall visit the site to determine if the existing conditions, nature of materials to be encountered, and all other facts concerning or affecting the work.

B. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted in writing by the Owner and then only after acceptable temporary utility services have been provided.

1. Provide a minimum 72-hours notice to the Owner and receive written notice to proceed before interrupting any utility.

2. For abandonment of existing utilities and foundations, see Section 02050, "Demolition."

C. Any water and debris, which would interfere with construction shall be removed from excavated areas. During rainy weather, maintain excavations free of water by pumping and other appropriate means. Excavations shall be free from loose material and free water while forms are being set and concrete is being placed. Pumping from excavations shall be performed in manner as to preclude the possibility of any portion of the concrete being carried away. All water resulting from dewatering operations shall be disposed of in accordance with the requirements of the City and County of San Francisco and/or the San Francisco Bay Regional Water Quality Control Board.

D. Throughout the entire construction period, keep dust down within the working area along roads used in the operations and all involved portions of site by intermittent watering and sprinkling. In accordance with Bay Area Air Quality Management District (BAAQMD) guidelines, unpaved access roads should be watered three times daily and other active construction areas twice daily. If necessary, all areas should be watered more frequently to prevent visible dust plumes from migrating outside of the development parcel.

E. Contractor shall keep his work area clean, and in a safe and workmanlike condition so that rubbish, waste and debris do not interfere with the work of other trades.

PART 2 - PRODUCTS

2.1 COMPACTION EQUIPMENT

A. Compaction equipment shall be of suitable type, adequate to obtain satisfactory breakdown of materials and specified relative compaction to form engineered fill.

B. Compaction equipment shall be operated in accordance with the manufacturer's instructions and recommendations. Equipment shall be maintained to deliver manufacturer's rated comparative effort. If inadequate densities are obtained, larger and/or different types of additional equipment capable of achieving specified relative compaction shall be used.

C. Vibratory equipment shall not be used where shallow groundwater is present that when vibrated will adversely affect compaction efforts. The contractor shall repair any subgrade/fill damaged by the use of vibratory equipment at no cost to the owner.

2.2 MOISTURE CONTROL EQUIPMENT

A. Equipment for applying water shall be of a type and quality which is adequate for the work, does not leak, and is equipped with a distributor bar or other approved device to assure uniform application. Equipment for mixing and drying materials shall consist of blades, discs or other equipment.

2.3 BURIED WARNING AND IDENTIFICATION TAPE

A. Buried warning and identification tape shall be metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 6 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes

Red: Electric
Yellow: Gas, Oil, Dangerous Materials, Auxiliary Water Supply System
Orange: Telephone and Other Communications
Blue: Water Systems
Green: Sewer Systems/Storm Drain Systems
Purple: Reclaimed Water

B. Detectable Warning Tape for Non-Metallic Piping

1. Detectable warning tape shall be polyethylene plastic tape conforming to the width, color and printing requirements specified above, but additionally containing integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Minimum thickness of tape shall be 0.10 mm. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Encase metallic element of the tape in a protective jacket or provide other means of corrosion protection.

2.4 SUITABLE BACKFILL MATERIAL

A. Backfill materials shall be Satisfactory Soil Materials: ASTM D 2487 soil classification groups GW, GP, GM, GC, SW, SP, SC and SM; free of rock or gravel larger than 4 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter. Other soil classifications shall be submitted to the project geotechnical engineer for approval before being used as backfill. The soil materials shall be 100 percent passing 3-inch sieve, a range of 35-100 percent passing No. 4 sieve size, and a range of 20-100 percent passing No. 30 sieve size. Satisfactory soil shall have a liquid limit less than 40 and a plasticity index lower than 12. Backfill for Low Pressure Water and Reclaimed Water Pipelines shall conform to the requirements for "Bedding and Cover for Low Pressure Water and Reclaimed Water Pipe."

B. Bedding and Cover Material: Where not specified in these specifications, bedding and cover material shall conform to SSDPWSF, Section 703 Trench Backfill of City Standard Specifications.

C. Bedding and Cover Material:

1. Storm Drain and Sanitary Sewer Pipelines: shall be an evenly graded mixture of crushed stone or crushed gravel with 100 percent passing a 1-inch sieve, 90 to 100 percent passing a 3/4-inch sieve, and not more than 5% passing the No. 4 Sieve. Recycled Material shall not be allowed.

2. Low Pressure Water and Reclaimed Water Pipelines: shall consist of dune sand or equivalent, free from rock, concrete, organic material and other objectionable material and shall have 100% passing the 3/8" sieve, 93% to 100% passing the No. 4 sieve and 0% to 10% passing the No. 200 sieve.

D. Joint Trench:

1. Backfill from trench bottom to four inches above all facilities within the trench shall be Select Backfill meeting PG&E Engineering Guidelines 4123 "Sand Specification" where 95% compaction is required within streets. One half (1/2) inch minus sand shall be used in all other areas.

2. Joint trench backfill above the sand shall be sand or imported soils containing not more than occasional rounded rocks less than 1/2 inch in diameter and no rocks greater than 1/2 inch in diameter.

3. Backfill for structures shall be imported soils containing not more than occasional rounded rocks less than 1/2 inch in diameter and no rocks greater than 1/2 inch in diameter.

4. All imported backfill material shall have a minimum electrical resistivity of 2,500 ohm-centimeters.

5. Stabilization Material for joint trenches may be sand, pea gravel or crushed rock with 100% passing a 1/2 inch screen and not more than 2% passing a No. 200 sieve.

6. Bedding for handholes, pull boxes, vaults and manholes shall be a 12- inch bed of 3/4 inch clean gravel, except for electrolier boxes.

E. Stabilization Material – See Section 02200. Stabilization material should be used when an unstable trench bottom is encountered.

F. Where crushed rock is used as backfill, bedding, cover, and/or stabilization material, it shall be entirely covered by a filter fabric (Mirafi 140 NC or accepted equivalent).

G. Stabilization Reinforcement Fabric – Mirafi 600X or accepted equivalent shall be provided where needed.

H. Trench Seals:

Trench seals are required on pipes that exceed a 10% slope on pipes where the bottom of the trench extends below the depth of contaminated groundwater.

1. For trench seals installed on pipes where the bottom of trench extends below the depth of contaminated groundwater, trench seals shall be installed at regular intervals.

2. For trench seals installed on pipes that exceed 10% slope, trench seals shall be spaced at least every 100’ installed at the nearest pipe joint as approved by the City. See plans for trench seal details if applicable.

The trench seal needs to extend pass the limits of the trench walls and shall extend from the excavated trench bottom up to within 3 feet of the ground surface. Trench seals shall be constructed of imported impermeable clay except in the case of Joint Trench where trench seals shall be lean concrete. Clay shall have a moisture content that does not exceed optimum moisture by more than 5%, and comply with Section 02200, paragraph 2.1.M.

I. Filter Fabric – Mirafi 140NC, or accepted equivalent.

PART 3 - EXECUTION

3.1 GENERAL

A. Trench excavation and backfill shall be performed in accordance with Part 7, City Standard Specifications, DPW Order No. 178,940, except as otherwise specified herein.

B. Excavated and Surplus Material: See Section 02200, 3.1 A., for handling, reuse and disposal requirements.

C. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

D. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.2 DEWATERING

A. Prevent surface water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Remove ponded water immediately.

C. Protect and/or repair subgrade from softening and/or damage by keeping excavations free of standing water at all times.

D. Any repair or recompaction required due to presence of ponded water shall be performed at no cost to Owner.

3.3 PAVEMENT EXCAVATION

A. The removal of pavement, sidewalk, parking strip and other roadway structures shall be performed in accordance with Section 701 'Pavement Excavation' of the City Standard Specifications, and in accordance with DPW Order No. 178,940 unless otherwise specified herein. Sawcuts in concrete pavement and parking strip shall be of sufficient size to provide neat, regular and vertical edges, but shall not be less than 3/4-inch in depth. The use of a saw may be omitted on approval of the Owner's Agent in streets where the existing pavement is due to be reconstructed or is in visibly poor condition.

3.4 TRENCH EXCAVATION

A. All Trench Excavation shall be performed in accordance with Section 702 'Trench Excavation' of the City Standard Specifications, DPW Order No. 178,940, unless otherwise specified herein.

1. In accordance with rules and regulations adopted by DPW, the trench length of all street openings shall not exceed the length of one block in any three-block section without special permission from the Department of Parking and Traffic. The amount of excavated trench in excess of pipe laid therein shall not exceed 200 linear feet at the end of each working day.

2. The depth of the trench cited shall be from a point below the gutter grade. The gutter grade shall be defined as the existing gutter grade or six inches below the official grade (grade at top of curb as established by the San Francisco Board of Supervisors) whichever is lower. The section of trench above the gutter grade shall be included in the cost of the excavation per linear foot of trench and no additional payment will be allowed for that section of trench cut from the present ground surface to the gutter grade. Where the existing pavement elevation is below the gutter grade, the depth of the trench shall be measured from the existing pavement grade.

3. The trench shall be excavated so that the barrel of the pipe will have an even bearing along its entire length, and with sufficient clearance provided for any necessary operations in connection with the laying of the pipe. Bell holes shall be excavated for each pipe bell or joint.

B. The trench shall be excavated in a manner to avoid existing structures, property, and other obstructions encountered during the progress of the work. The Contractor shall support, protect, maintain, and provide for the safe operation and use of all such structures and property so encountered. Should the Contractor damage any structure or property during the progress of the work, he shall immediately notify the proper owners or authorities and shall arrange repair of the same at his expense.

C. All excavations in Bay Mud shall be shored.

D. When Bay Mud or soft, wet soil is encountered at the trench bottom, a stabilization reinforcement fabric shall be placed and overlain by at least 12 inches of stabilization material as needed to provide a non-yielding subgrade and covered entirely by filter fabric (Mirafi 140 NC), unless greater measures are specified in the plans or as directed by the Owner's Agent (Representative of Geotechnical Engineer).

E. Explosives: Do not use explosives.

F. Unclassified Excavation: Excavation is unclassified and includes excavation to required subgrade elevations regardless of the character of materials and obstructions encountered.

G. Comply with the geotechnical report, local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

H. Excavations shall be sloped, or supported and braced to prevent movement of the adjacent soil. Shoring and bracing systems shall be designed by a Civil Engineer registered in the State of California. Drawings and Calculations for shoring shall be submitted for review by the Owner's Agent.

3.5 EXCAVATION OF STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.10 foot. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections.

B. Prior to placement of any concrete (either lean concrete or structural concrete), the soil at the exposed subgrade shall be rolled to produce a smooth, non-yielding surface.

C. Soft or wet materials encountered at excavation subgrade shall be removed and replaced with lean concrete, engineered fill, crushed rock, stabilization material, or cement-treated soil, as approved by the Owner's Agent (Representative of Geotechnical Engineer) to provide non-yielding subgrade. In soft soil conditions, a stabilization reinforcement fabric may be placed as needed prior to placement of these materials. Where open-graded crushed rock or stabilization material is used, it shall be covered entirely by filter fabric.

3.6 APPROVAL OF SUBGRADE

A. Notify the Owner's Agent (Representative of Geotechnical Engineer) 48 hours prior to excavations reaching required subgrade.

B. When the Owner's Agent (Representative of Geotechnical Engineer) determines that unforeseen unsatisfactory soil is present, continue excavation and replace with compacted backfill or lean concrete as directed.

1. Unforeseen additional excavation and replacement material will be paid according to the Contract provisions for changes in Work.

C. Reconstruct subgrades damaged by sun, rain, accumulated water, or construction.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete fill shall be used to bring elevations to proper position when acceptable to the Owner's Agent (Geotech).

B. Fill unauthorized excavations under other construction as directed by the Owner's Agent (Geotech).

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. See Section 02200, Paragraph 3.1. Stockpile soil materials without intermixing except when directed otherwise by Owner's Agent. Place, grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of existing trees.

2. For soil stockpiles in place for less than 30 days, cover, enclose, water twice daily, or apply non-toxic soil binders.

3. For soil stockpiles in place for more than 30 days, cover with anchored plastic sheeting or hydroseed.

4. For soil stockpiles in place for one year or greater, the stockpiles must be hydroseeded or similarly covered.

5. During the rainy season, all stockpiles must be covered with anchored plastic sheeting, hydroseeding, or another equivalent cover.

B. Relocate, flatten, or otherwise remedy any stockpile of materials determined likely to impact existing or proposed structures through induced settlement.

C. Remove excess excavated material from site immediately. Prior to deposing of soils offsite, Owner approval must be granted.

3.9 TRENCH BACKFILLING

A. Backfill excavations promptly, but not before completing the following:

1. Acceptance of construction below finish grade.

2. Concrete formwork removal.

3. Removal of trash and debris from excavation.

4. Removal of temporary shoring and bracing, and sheeting.

5. Backfill around pipe for the full width according to Section 703, City Standard Specifications with suitable bedding and cover material. Backfill a minimum of 4 inches below the bottom of pipe and six inches above top of pipe.

6. Where fine grained soil is used as backfill over course grained soil, a filter fabric shall be installed between those zones.

B. Place backfill materials in layers not more than 8 inches in loose lifts.

C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages relative compaction according to ASTM D 1557:

1. Under on-site sidewalks, steps, and pavements, compact the top 6 inches below subgrade and each layer of backfill or fill material to 95 percent relative compaction.

2. Under non-pile-supported structures and slabs-on-grade, compact the top 12 inches below subgrade and each layer of backfill or fill material to 95 percent relative compaction.

3. Under city streets, from back of curb to back of curb, compact the subgrade soil within the upper 36 inches of finished roadway surface to 95 percent relative compaction.

4. Under city sidewalks, which are not otherwise referred to as Specialty Sidewalks, compact fill to 90 percent relative compaction.

5. Under specialty sidewalks compact upper 6 inches below subgrade to 95% relative compaction.

6. Below the specified depths (items 1 through 4 above) backfill or engineered fill material at least 90 percent relative compaction.

D. Jetting shall not be permitted.

E. Crushed rock shall be placed in the trench bottom when required to maintain an appropriately dry trench (see Section 703.05, City Standard Specifications). It shall be covered entirely by filter fabric.

G. Warning and identification tape shall be placed parallel to the centerline of the pipe in the trench backfill at an elevation of 18 inches above the top of the pipe, unless otherwise indicated.

H. All open-graded rock shall be overlain entirely by filter fabric.

3.11 FIELD QUALITY CONTROL

A. Testing Agency Services: The Owner's Agent will test subgrade and fill or backfill layer at representative locations as they see fit. Contractor shall not proceed until test results for previously completed work verify compliance with requirements.

B. Whenever acceptance by the Owner's Agent is required by these Specifications, the Contractor shall notify the Owner's Agent at least 48 hours prior to commencing any phase of earthwork.

1. No phase of the work shall proceed until the prior phase of work has been accepted by the Owner's Agent (Geotech).

2. Work shall not be covered up or continued until acceptance of the Owner's Agent (Geotech) has been obtained.

3. The Owner's Agent (Geotech) will give written notice of conformance with the Specifications upon completion of grading.

C. The Owner's Agent (Geotech) has been retained to observe performance of work under this section.

1. If in the opinion of the Owner's Agent (Geotech), the work performed does not meet the technical or design requirements stipulated, the Contractor shall make the necessary readjustments as required by the Owner's Agent (Geotech).

2. No deviations from the contract documents shall be made without specific and written acceptance of the Owner's Agent (Geotech).

3. In the event of conflict between the Specifications and the recommendations contained in the Geotechnical Report, the Owner's Agent (Geotech) shall be notified.

a. The Contractor shall follow clarification and interpretation memoranda prepared by the Owner's Agent (Geotech) at no additional cost to the Owner.

b. If clarification or interpretation memoranda should result in a change in the scope of work, an adjustment in the contract price will be mutually agreed upon by the Contractor and the Owner.

D. The Owner's Agent (Geotech) review of the Contractor's performance does not include review of the Contractor's safety measures.

3.12 PROTECTION

A. Protecting Excavated Areas: Protect newly excavated areas from traffic and erosion. Keep free of trash and debris.

B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Owner's Agent

2. Reshape and recompact optimum moisture content to the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, scarify upper eight inches, moisture condition and recompact subgrade to moisture condition and Relative Compaction per the recommendations in the Geotechnical report, then backfill with additional approved material at required compaction, and reconstruct surfacing, at no cost to the owner.

3.13 SAFETY PRECAUTIONS

Contractor shall maintain substantial precautions and other protective measures to safeguard workmen and the general public from bodily injury. As part of standard safety precautions, contractor must prepare an Environmental Health and Safety Plan.

3.14 ABANDONMENT OF SUBSURFACE UTILITIES

See Section 02050, "Demolition."

3.15 EXCAVATION FOR POLE FOUNDATIONS

A. Stake and verify all locations for pole foundations. Bring any conflicts to the attention of the Owner's Agent.

B. Field verify all underground utility locations prior to foundation excavation.

C. After establishing the location of pole foundations, and prior to starting excavation, conduct a survey walkout with the Owner's Agent, and any other parties affected by foundation locations, in order to resolve any problems resulting from the pole placement in the indicated location.

D. If adjustments to the pole foundation locations are required, obtain Owner's Agent's approval for foundation relocation.

E. Drill the foundation shafts at locations and to the dimensions and depths as indicated on the Project Drawings and control them within the specified tolerances. Where foundation is located in structural soil trench, coordinate observation by Owner's Agent.

F. Abandoned pipe, concrete, boulders and other obstructions, which extend into the foundation shafts and prevent the proper formation of foundations shall be removed. Permanent utility lines and piping which interfere with foundations shall be brought to the Owner's Agent's attention.

G. Blasting, as foundation excavation, shall not be permitted.

H. Remove and dispose of excavated drilling material that are surplus, or do not comply with the reusable materials as determined by the Owner's Agent, to an approved disposal site.

I. Use steel casing shells, where needed or required by the Owner's Agent, to control ingress of water or prevent caving of the pier shaft.

J. Cover foundation shafts to prevent possible hazards.

K. Remove all loose material from the bottom of the drilled shafts and dewater as required prior to and during placing of concrete.

L. Remove anchor bolts template and reuse elsewhere not less than two days after the concrete has been placed.

END OF SECTION

SECTION 02512

LOW PRESSURE WATER

PART 1 – GENERAL

1.1 REFERENCE STANDARDS

A. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), Latest Edition. Also referred to as "City Standard Specifications."

B. Standard Plans of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SPDPWSF), Latest Edition. Also referred to as "City Standard Plans."

C. Department of Public Works (DPW) Order No. 176,707 "Regulations for Excavating and Restoring Streets in San Francisco", approved March 26, 2007.

D. AWWA Standards, Latest Revision.

E. SFWD standard drawings, SFWD Rules and Regulations governing Water Services to customers, Latest Editions.

F. California Waterworks Standards, R-14-03, CA DPH

G. California Administrative Code, Title 22, §64572, Water Main Separation.

1.2 WORK INCLUDED

A. Section includes (but is not necessarily limited to):
   1. Furnishing and Installation of low-pressure water pipe and fittings.
   2. Installation of water services.

B. Comply with all other provisions of the Plans and these Specifications.

1.3 RELATED SECTIONS

A. Section 02225, "Excavation, Backfilling and Compacting for Utilities".

B. Section 13111, "Cathodic Protection of Reclaimed and Low Pressure Water Pipelines."

C. See SFWD Standard Drawings, Appendix A.

1.4 QUALITY ASSURANCE

A. All testing required by this Section and other Sections of these Specifications shall be witnessed by the Owner's Agent. Retesting required as a result of failed tests shall be at the expense of the Contractor.

1.5 EQUIPMENT

A. Contractor shall ensure that all equipment used on this site is operated, inspected and maintained in accordance with applicable Cal/OSHA standards.

1.6 SUBMITTALS

A. Submit complete specifications, catalog information and cuts, descriptive drawings, and literature for each equipment item to be furnished under this Section, with all exceptions to the Specifications noted. Provide submittals for:
1. Ductile iron pipe and gaskets
2. Valves, Fittings & Appurtenances
3. Paint
4. Polyethylene Encasement Material for Ductile Iron Pipe
5. Trench support plans and calculations (for depths greater than 5 feet).
6. Flexible Joint
7. Service Pipe and Fittings
8. Lug, tie rods and other devices for restraining pipe points
9. Marking tape
10. Meter box and cover
11. Valve box and cover
12. Valve Operating Nut Extension (For Deep Valves)
13. Anode Test Station box and cover
14. Cathodic protection
15. Other materials or drawings necessary to complete the installation.

PART 2 – PRODUCTS

2.0 SOURCE OF MATERIALS

A. All pipe, valves and fittings shall be manufactured in the USA, by companies engaged in the manufacture of such items for five (5) or more years. US Pipe, American Cast Iron Pipe, or accepted equal.

B. Fire service lateral materials, linings, and coatings shall be certified by the National Sanitation Foundation (NSF).

2.1 PIPE

A. Piping Materials Less Than 4”
1. Pipe shall be copper tubing, type K and shall conform to CCR Title 22, Section 64570. Soft or hard type K copper tubing shall be per service size as shown in SFWD Standard Drawings.
2. Bronze Valves and Fittings shall conform to AWWA C800 and be the same as awarded under the current City Procurement Contract for such materials.
3. Angle cocks shall be Ford Angle Ball Meter Valve with stainless steel bolts and nuts.

B. Piping Materials 4" To 12"

1. Pipe shall be ductile iron, Class 53 and conforming to the latest revision of ANSI/AWWA C151/A21.51 and shall conform to CCR Title 22, Section 64570.
2. Pipe shall be bell and spigot, push-on type, tyton joint that is designed to accommodate "Field-Lok™" gaskets.
3. The ductile iron pipe shall be cement-mortar lined conforming to ANSI/AWWA C110/A21.10 or ANSI/AWA C153/A21.53. The cement mortar lining shall be double the standard thickness.
4. Pipe shall be the same as awarded under the current City Procurement Contract for such materials.

C. Piping Materials Larger Than 12"

1. Pipe shall be ductile iron, Class 53 and conforming to the latest revision of ANSI/AWWA C151/A21.51 and shall conform to CCR Title 22, Section 64570.
2. Pipe shall be bell and spigot with TR FLEX joint.
3. The ductile iron pipe shall be cement-mortar lined conforming to ANSI/AWWA C110/A21.10 or ANSI/AWA C153/A21.53. The cement mortar lining shall be double the standard thickness.
4. Pipe shall be the same as awarded under the current City Procurement Contract for such materials.

D. For Service Lateral pipe incorporating flanged fittings:

1. Flanges shall match the type used by SFWD for meters and appurtenances.
2. All flange bolts and nuts shall be in accordance with ANSI B-16.42, 1979 Class 300 except material for the bolts shall be stainless steel, ANSI Type 304 ASTM A 193 B8, Class II and material for the nuts shall be stainless steel, ANSI Type 304 ASTM A 194 B8, Class I.55
3. All gaskets shall conform to ANSI/AWWA C111/A21.11 standard. Flange joint gaskets shall be full face, non-asbestos with nitrite NBR binder, 1/8" thick.

2.2 VALVES

A. Corporation stops shall be used for service laterals 2" diameter and smaller. Corporation stops shall be tapped into the main as shown in the SFWD Standard Drawings.

B. Gate valves shall be used for pipe sizes 4" diameter and larger. Gate valves shall conform to ANSI/AWWA C509 and NSF 61 certified. Gate valves shall have push-on by push-on (Tyton by Tyton) ends designed to accommodate U.S. Pipe "Field-Lok" gaskets, have a non-rising stem, and be resilient seated, right turn open, nut operated, and epoxy coated. Gate valves shall be the approved make and model per the latest City Purchasing Contract for gate valves.

2.3 FITTINGS

A. All Ductile Iron Push-On Joint Fittings shall conform to all applicable requirements of ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53, latest revisions, unless otherwise specified herein. Fittings shall be designed to accommodate "Field-Lok™" type gaskets. Fittings shall be the same as awarded under the current City Procurement Contract for such materials.

2.4 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement for ductile iron pipe and fittings shall be clear in color, 8 MIL in thickness, low density, and shall conform to AWWA C105.

2.5 JOINT RESTRAINT DEVICES

A. Joint Restraint Devices shall be per SFWD standard drawings, except that bolt, nut, and tie-rods shall be stainless steel TP304.

2.6 IDENTIFICATION TAPE

A. Refer to section 02225.

2.7 METER BOX AND COVER

A. Meter box shall be as indicated in Appendix A, size shall be per meter size indicated on plan. Cover shall be as indicated in Appendix A, D&L Foundry A Supply Model L-2468, selected and arranged as shown on meter box detail sketches.

2.8 VALVE BOX AND COVER

A. Same product and lettering on cover as currently used by SFWD.

2.9 ANODE TEST STATION BOX AND COVER

A. Christy G5 Traffic valve box 10 3/8” ID x 12”H, with 1 1/2” locking grade ring. Label iron cover as indicated in Section 13111.

2.10 WAX TAPE SYSTEM

A. The purpose of these additional construction measures are to minimize intrusion/contamination from potential leaks in the AWSS/storm drain and tertiary water lines. These criteria are needed to comply with SFPUC variance from California State Title 22 Waterworks standards Section 64572d, per CDPH agreement, 4/9/14.

B. Wax tape primer shall be Trenton Wax-Tape Primer or accepted equal

C. Wax tape shall be Trenton Wax-Tape #1 or accepted equal

D. Plastic wrapper shall be Trenton Poly-Ply or accepted equal

2.11 BACKFLOW PREVENTER

A. Backflow preventer shall be FEBCO MasterSeries LF880V Reduced Pressure Zone Assembly and shall be lead free

PART 3 – EXECUTION

3.1 WATER PIPE INSTALLATION

A. Low pressure water mains shall be installed per California Code of Regulations, Title 22, CA Department of Public Health.

B. At crossings between the low pressure water main and the sanitary sewer main, low pressure water joints shall be 8-feet minimum away from the outside diameter of the sanitary sewer main.

C. Construction staking for water mains shall include reference points indicating offset and elevation to pipe at 50-foot station maximum.

D. The trench shall be excavated so that a 4-inch thick layer of sand bedding can be installed beneath the pipe bottom such that the barrel of the pipe will have an even bearing along its entire length, and with sufficient clearance provided for any necessary operations in connection with the laying of the pipe. Bell holes shall be excavated for each pipe bell or joint.

E. Before any pipe may be installed, the grade of the trench bottom shall be to the satisfaction of the Owner's Agent. Immediately prior to installing the pipe, the contractor shall remove all loose rocks and other objectionable material from the bottom of the trench and bell holes. When the trench is properly prepared, the pipe shall be lowered therein, singly, without jar or strain and assembled by piece inside the trench.

F. Joints less than 4’ from the outside diameter of the recycled water, AWSS, or storm drain pipe at a crossing shall be encased. Encasement shall consist of wax tape primer, wax tape, and poly-ply conforming to Section 2.10 of these specifications.

G. The pipe shall be joined in strict adherence to the pipe manufacturer's printed installation instructions.

H. When the pipe is cut in the field, the outside of the cut end shall be beveled about one-quarter inch at an angle of about 30 degrees and the leading edge rounded.

I. If the joint assembly is not accomplished with the application of reasonable force, the plain end of the pipe shall be removed to check the proper position of the gasket. At the end of each day, the contractor shall plug the end of the laid pipe. No pipe shall be placed within the trench closer than 75 feet from the end of said trench as excavated, or from any obstruction visible in said trench area. The purpose of this stipulation is to permit the Owner's Agent to adjust said trench line and grade as conditions require.

J. Thrust blocks shall be installed on fire hydrant laterals per standard drawings in Appendix A.

K. All connections to existing water mains will be made by the Water Department. Contractor shall coordinate with the City Water Department to facilitate connection of the new and existing system.

L. Provide locating/marking tape in the trench, continuously over the centerline of the pipe, as per Section 02225, "Excavation, Backfilling and Compacting for Utilities."

M. The entire pipe system, including service laterals, shall be encased with clear polyethylene tubes or sheets in accordance with AWWA C105.

N. All rubber gasket joints, fusion epoxy coated flanges and flexible couplings on ductile iron pipelines shall be bonded with insulated copper cable to insure electrical continuity of pipeline and fittings.

O. Insulating flanges and/or couplings shall be installed to electrically isolate the buried portion of pipeline from other metallic pipelines, reinforced concrete structures and above grade buildings or structures.

P. All joints on service laterals shall be restrained per SFWD Standards.

Q. Pipe is generally to be laid at a depth such that the gate valve operating nut is 12” to 24” below finish grade, unless otherwise indicated on the drawings. Where gate valve operating nut is deeper than 24” below finish grade, Contractor shall provide fabricated extension with 2” square nut at 12” to 18” below finish grade.

3.2 INSTALLING PIPE FITTINGS

A. The Contractor shall include the procurement, placing, restraining, and protecting of all fittings, valves, joint restraints, and all other appurtenances to be incorporated in the work, all as indicated in the Contract Documents or as directed by the Owner's Agent.

B. Installation:

Pipes and fittings shall be installed per the manufacturer’s installation instructions, and as directed by the Owner's Agent.

Caps shall be fastened to the pipe by use of tie rods and lugs or restrainers as shown on Standard Drawing E-4969. Additional lug and tie rod joint restraints shall be installed at locations directed by the Owner's Agent.

The Contractor shall paint all tie rods, lugs, restraining ring assembly, bands and other miscellaneous metal attached to the pipeline and hydrant bury, installed by the Contractor and by the Water Department during main connections, or large service connections, with two (2) coats Kopper Bitumastic No. 505 or two (2) coats Protecto Wrap CA160 or accepted equal, applied in accordance with the manufacturer's directions.

Installation of securing devices for fittings, such as lugs, restraining ring assembly, bands, tie rods, and other miscellaneous metal, and furnishing and application of protective painting to devices will be considered as incidental work, and no direct payment will be made therefore.

C. Valve Boxes:

Over each valve, blow-off, or other similar appurtenance, a piece of ductile iron pipe of such size as may be required by the Water Department shall be placed vertically to form a valve box. A City standard cover shall be placed on top of the pipe or box. The bottom of the box shall rest on a steel plate required by the Water Department so placed as to prevent the box from bearing on the gate. Steel plates supporting boxes, over blow-offs or air valves shall be set on an asphalt bed. Contractor shall cut the box to such lengths that the top of the gate cover will be flush with the surface of the finished pavements shown on Standard Drawing E-4969.

D. Fire Hydrant Services:

1. Hydrant from existing main – SFWD will install hydrant lateral, valve, bury and breakaway riser. Owner will pay for SFWD to install hydrant on riser. The contractor shall do all excavation, backfill and pavement restoration.

2. Hydrant from new main – Contractor shall install hydrant lateral, valve, bury, and riser. Owner will pay for SFWD to install hydrant and breakaways. The contractor shall do all excavation, backfill and pavement restoration.

In either case (1. or 2. above) Contractor shall pay for all materials involved in the project.

Hydrant gate valves and burys, required for hydrant services shall be purchased and procured by contractor. Installation of hydrant and riser shall be coordinated with San Francisco Water Department through DPW/ITF.

Centerline of hydrant shall be located 24” minimum and 27” maximum from face of curb, measured perpendicular to the curb face.

Hydrant gate valves and burys for hydrant services shall be secured by installing lugs, restraining ring assembly, band and tie rod bolts as directed by the Owner's Agent, and/or as shown on Standard Drawing E-4969. Installation of securing devices for hydrant gate valves and burys will be considered incidental work and no direct payment will be made therefore.

3.3 IDENTIFICATION OF “FIELD-LOK™” GASKET JOINTS

A. The Contractor shall identify all joints with “Field-Lok™” gaskets by spraying white marking paint on top of each bell and also by taping a direct burial tape around the spigot end of each pipe, just in front of the bell.

3.4 HYDROSTATIC TEST IN THE FIELD

A. When the pipeline or a portion of the pipeline laid under this contract is completed, the Contractor shall test the line to a hydrostatic pressure of 225 pounds per square inch. The actual pressure test of 225 psi shall be maintained for not less than 2 hours during which time no additional water shall be added to the line under test. Unless otherwise directed by the Owner's Agent, the pipe joints shall be exposed during the test. All service lines to be incorporated in the pipeline shall be installed before the pipeline may be tested and shall be included in the test.

The Contractor shall furnish all necessary labor, material and equipment, such as pumps, piping, connections, pressure gauges, etc., for the test. The Contractor shall also furnish and install necessary anchorage and blocking to prevent movement of the pipe under test.

If any section of the pipe under test develops a leak visible to the eye in the rubber gasket joints or in the pipe itself, the Contractor shall repair or replace the defective portion of the pipe as directed by the Owner's Agent, at no additional cost. After all repairs are made, the pipe shall be retested.

3.5 INSTALLING SHORING

A. Work Included:

The Contractor shall install an approved shoring system for all excavations five (5) feet or more in depth.

All shoring shall be installed in accordance with standards established by the California Division of Industrial Safety and in conformance with all other applicable rules and requirements.

If the Contractor intends to use a shoring plan which varies from the Standards established by the California Division of Industrial Safety, the plan shall be prepared and signed by a Registered Civil Engineer and submitted to the Owner's Agent for approval at least ten (10) working days before the Contractor intends to begin excavating. The Contractor shall not start excavation prior to approval of the shoring plan by the Owner's Agent.

In locations where the Water Department crews will install service lines or connections to other lines, regardless of depth, the Contractor shall install a solid sheeting type shoring system, approved by the Owner’s Agent that is capable of protecting all excavations from excessive water that may be present and give ample access to the crews to perform the installation. This shoring system is more stringent than CAL/OSHA Standards.

All shoring materials and equipment shall be removed from the excavation prior to completion of work.

3.6 INSTALLATION OF SCREW TAPS

A. Work Included:

The Contractor shall drill, tap and install all screw taps and risers as indicated or as required by the Owner's Agent.

B. Installation:

Any screw taps not satisfactorily installed in the opinion of the Owner's Agent shall be removed and replaced at the expense of the Contractor. Where the screw tap installation is unsatisfactory, it shall be removed and replaced with a solid cast iron plug. The Contractor shall relocate screw taps at locations as directed by the Owner's Agent.

3.7 INSTALLATION OF SERVICE PIPE

A. Work Included:

The Contractor shall remove pavement; excavate service trench; provide and install service pipe and fittings; complete in place and ready for connections with service meter or existing service pipe; furnish and place backfill material in the trench; and clean the site of the work together with all other work necessary or incidental thereto. See Appendix A, Meter Vault Details, for layout of lateral pipe and fittings.

The location of services indicated on the drawings are subject to change as directed by the Owner's Agent. Service pipe larger than two inches nominal diameter shall be ductile iron.

B. Service Trench Excavation and Backfill:

All work and materials included in this Item shall be in accordance with the provisions of Section 02225, "Excavation, Backfilling and Compaction for Utilities." The service trench shall be of sufficient width to properly install the service pipe and have a flat bottom of at least two feet below the gutter grade, as indicated on the project drawings. The bottom of the trench shall slope uniformly to the main from a point approximately ten feet from the main.

C. Service Fittings:

Service fittings shall be flare type fittings, soldered joint type fittings, or other type fittings currently in use by Water Department. Contractor shall make cold flares by use of flaring tools approved by the Water Department whenever a flare-type fitting is furnished. Heat shall not be applied to flare tubing. Joints for other types of fittings shall be in accordance with the method recommended by the manufacturer and approved by the Water Department. Refer to Standard Drawing E-4969, Appendix A.

Provide insulating type joints to electrically separate dissimilar pipe materials where dissimilar pipe materials are joined.

D. Installing Service Pipe and Fittings:

For new service laterals that connect to existing water mains, SFWD shall install the service lateral pipe from the water main to the meter and make all related connections. The Contractor shall do all excavation, pavement restoration and meter box installation. For new service laterals that connect to new water mains, the Contractor shall install service pipe, including connections to the new water mains. The Contractor shall install service pipe and fittings to a point inside the meter box, and thence from the meter box to one foot beyond the back of sidewalk, or as otherwise directed by the Owner's Agent. The Contractor shall coordinate with the Water Department to confirm the flange to flange dimension for each meter installation prior to service pipe installation. The service meter will be installed and connected to the service line by the Water Department.

For Fire Water (FW) service laterals: contractor to install double bell flange adapter at one foot behind curb which shall incorporate an insulating flange kit. Install FW lateral to one foot beyond property line.

The Contractor shall use jacking methods to install service pipe across existing traffic lanes wherever possible. Approval of the Owner's Agent shall be obtained before any excavation for service line is permitted in the existing traffic lanes.

E. Meter Boxes:

Contractor shall procure and purchase and install meter boxes. Contractor shall purchase, procure, and install meter box covers. Contractor shall accurately locate the meter box installation in the field and confirm piping arrangement so that box and cover is integrated into the streetscape in accordance with the project drawings, including the landscape details. Contractor shall adjust meter box to appropriate grade and install cover. Contractor to provide excavation, stabilization material under box, and backfill.

3.8 REMOVAL OF WATER DEPARTMENT-OWNED VALVE BOX AND COVER

A. The Contractor shall remove all existing Water Department valve boxes and valve covers, if any, that are to be abandoned in this contract or as indicated by the Owner's Agent. The Contractor shall saw cut, excavate, remove and dispose of pavement; excavate the hole to the dimensions indicated (or required); remove the box and dispose of as his/her property, place and maintain all traffic routing and public safety requirements; furnish and place sand backfill; restore pavement, sidewalk, and other roadway structures that have been removed during the progress of the work, unless otherwise specified herein, and clean the site of the work together with all other work necessary or incidental thereto.

B. The Contractor shall return all box covers to the Water Department Corporation Yard at 1990 Newcomb Avenue, or at the location indicated by the Owner's Agent.

C. Removal of Valve Box and Cover:

The Contractor shall notify the Owner's Agent in writing 7 calendar days prior to scheduling the removal of abandoned valve boxes and valve covers. The Owner's Agent shall identify the abandoned valve boxes and covers that are to be removed by marking them in the field. Removal work shall be completed before surrounding finish grade work. The Contractor shall saw cut the pavement around the valve cover (minimum 2 foot x 2 foot square) and remove the valve box at least 18 inches below the roadway surface. The removal of the plate under the valve box is optional.

The hole shall be backfilled in accordance with the provisions of Section 02225, "Excavation, Backfilling and Compacting for Utilities."

The concrete base and pavement removed shall be restored to match the existing, or as indicated on the Contract Drawings.

3.9 INSTALLATION OF BACKFLOW PREVENTERS

A. Install all backflow prevention assemblies per manufacturer’s instructions.

B. All backflow prevention assemblies shall be tested and certified in conformance with the SFPUC’s Instructions for Certified Backflow Prevention Assembly Testers, which is included in Appendix C.

3.10 DISINFECTION

A. Upon completion of satisfactory hydrostatic test, the Water Department will disinfect the main. The Water Department will supply and install all piping, fittings and other materials necessary to chlorinate the main, except screw taps and risers, which shall be installed by the Contractor. The Contractor shall not backfill the site of such work until the satisfactory disinfection of the main is verified by the Owner's Agent.

END OF SECTION

SECTION 02513

RECLAIMED WATER

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

A. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), Latest Edition. Also referred to as "City Standard Specifications."

B. Standard Plans of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SPDPWSF), Latest Edition. Also referred to as "City Standard Plans."

C. Department of Public Works (DPW) Order No. 176,707 "Regulations for Excavating and Restoring Streets in San Francisco", approved March 26, 2007.

D. AWWA Standards, Latest Revision.

E. California Waterworks Standards, R-14-03, CA DPH

F. California Administrative Code, Title 22, §64572, Water Main Separation

1.2 WORK INCLUDED

A. Section includes (but is not necessarily limited to) furnishing and installation of reclaimed water pipe and fittings.

B. Comply with all other provisions of the Contract Documents.

1.3 RELATED SECTIONS

A. Section 02225, "Excavation, Backfilling and Compacting for Utilities".

B. Section 13111, "Cathodic Protection of Reclaimed and Low Pressure Water Pipelines."

C. See SFWD Standard Drawings, Appendix A.

1.4 QUALITY ASSURANCE

A. All testing required by this Section and other Sections of these Specifications shall be witnessed by the Owner's Agent. Retesting required as a result of failed tests shall be at the expense of the Contractor.

1.5 EQUIPMENT

A. Contractor shall ensure that all equipment used on this site is operated, inspected and maintained in accordance with applicable Cal/OSHA standards.

1.6 SUBMITTALS

A. Submit complete specifications, catalog information and cuts, descriptive drawings, and literature for each equipment item to be furnished under this Section, with all exceptions to the Specifications noted. Provide submittals for:
1. Ductile iron pipe and gaskets
2. Valves, Fittings & Appurtenances
3. Paint
4. Polyethylene Encasement Material for Ductile Iron Pipe
5. Trench support plans and calculations (for depths greater than 5 feet).
6. Flexible Joint
7. Service Pipe and Fittings

PART 2 - PRODUCTS

2.0 SOURCE OF MATERIALS

A. All pipe, valves and fittings shall be manufactured in the USA, by companies engaged in the manufacture of such items for five (5) or more years. US Pipe, American Cast Iron Pipe, or approved equal.

2.1 PIPE 4" AND LARGER

A. Pipe shall be ductile iron, Class 53 and conforming to the latest revision of ANSI/AWWA C151/A21.51 Pipe shall be bell and spigot, push-on type, tyton joint that is designed to accommodate "Field-LokTM" gaskets. Pipe shall be the same as awarded under the current City Procurement Contract for such materials. The cement mortar lining shall be double the standard thickness.

B. For Service Lateral pipe incorporating flanged fittings:
1. Flanges shall match the type used by SFWD for meters and appurtenances.
2. All flange bolts and nuts shall be in accordance with ANSI B-16.42, 1979 Class 300 except material for the bolts shall be stainless steel, ANSI Type 304 ASTM A 193 B8, Class II and material for the nuts shall be stainless steel, ANSI Type 304 ASTM A 194 B8, Class I.55
3. All gaskets shall conform to ANSI/AWWA C111/A21.11 standard. Flange joint gaskets shall be full face, non-asbestos with nitrite NBR binder, 1/8" thick.

2.2 VALVES

A. Corporation stops shall be used for service laterals 2" diameter and smaller. Corporation stops shall be tapped into the main as shown in the SFWD Standard Drawings.

B. Gate valves shall be used for pipe sizes 4" diameter and larger. Gate valves shall conform to ANSI/AWWA C509 and NSF 61 certified. Gate valves shall have push-on by push-on (Tyton by Tyton) ends designed to accommodate U.S. Pipe "Field-Lok" gaskets, have a non-rising stem, and be resilient seated, right turn open, nut operated, and epoxy coated. Gate valves shall be the approved make and model per the latest City Purchasing Contract for gate valves.

2.3 FITTINGS

C. All Ductile Iron Push-On Joint Fittings shall conform to all applicable requirements of ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53, latest revisions, unless otherwise specified herein. Fittings shall be designed to accommodate "Field-LokTM" type gaskets. Fittings shall be the same as awarded under the current City Procurement Contract for such materials.

2.4 FLEXIBLE JOINT (USED ONLY WHEN SPECIFICALLY INDICATED ON DRAWINGS)

A. Flexible Joint shall be EBAA Iron Ductile Iron, Series 1100, Flexible Expansion Joints. Bolts used in connections shall be 316 stainless steel. Flexible Expansion Joints shall conform to ANSI/AWWA C153/A21.53 and pass a pressure test of a minimum of 350 psi. Flexible Expansion Joints shall consist of an expansion joint designed and cast as an integral part of a ball and socket type flexible joint; having a minimum per ball deflection of 20 degrees for 3" – 12" diameter pipe and 6" minimum expansion.

2.5 PIPING MATERIALS LESS THAN 4"

B. Pipe shall be copper tubing, type K and shall conform to CCR Title 22, Section 64570. Soft or hard type K copper tubing shall be per service size as shown in SFWD Standard Drawings.

C. Bronze Valves and Fittings shall conform to AWWA C800 and be the same as awarded under the current City Procurement Contract for such materials.

D. Angle cocks shall be Ford Angle Ball Meter Valve with stainless steel bolts and nuts.

2.6 POLYETHYLENE ENCASEMENT

A. Polyethylene encasement for ductile iron pipe and fittings shall be purple in color, 8 mils in thickness, low density, and shall conform to AWWA C105.

2.7 METER BOX AND COVER

A. Meter box shall be as indicated in Appendix A, size shall be per meter size indicated on plan. Cover shall be as indicated in Appendix A, D&L Foundry A Supply Model L-2468, selected and arranged as shown on meter box detail sketches.

2.8 MARKING TAPE

A. Refer to section 02225.

2.9 VALVE BOX AND COVER

A. Valve box and cover shall be as indicated in Appendix A for reclaimed water. Valve boxes shall have a special, heavy-duty, triangular cover, with the following inscription cast on the top surface: "RECLAIMED WATER", plus a universal icon for non-potable water (Figure B-2, Appendix A)

PART 3 - EXECUTION

3.1 RECLAIMED WATER PIPE INSTALLATION

A. Construction staking for RWL shall include reference points indicating offset and elevation to pipe at 50-foot station maximum.

B. The trench shall be excavated so that a 4-inch thick layer of sand bedding can be installed beneath the pipe bottom such that the barrel of the pipe will have an even bearing along its entire length, and with sufficient clearance provided for any necessary operations in connection with the laying of the pipe. Bell holes shall be excavated for each pipe bell or joint.

C. Before any pipe may be installed, the grade of the trench bottom shall be to the satisfaction of the Owner's Agent. Immediately prior to installing the pipe, the contractor shall remove all loose rocks and other objectionable material from the bottom of the trench and bell holes. When the trench is properly prepared, the pipe shall be lowered therein, singly, without jar or strain and assembled by piece inside the trench.

D. Joints for pipe, fittings, and valves shall be fastened by use of “Field-LokTM” Gaskets unless otherwise directed by the Owner's Agent.

E. The pipe shall be joined in strict adherence to the pipe manufacturer's printed installation instructions.

F. When the pipe is cut in the field, the outside of the cut end shall be beveled about one-quarter inch at an angle of about 30 degrees and the leading edge rounded. The prepared cut end shall be marked at 3-1/4” for an 8” water line.

G. If the joint assembly is not accomplished with the application of reasonable force, the plain end of the pipe shall be removed to check the proper position of the gasket. At the end of each day, the contractor shall plug the end of the laid pipe.

H. No pipe shall be placed within the trench closer than 75 feet from the end of said trench as excavated, or from any obstruction visible in said trench area. The purpose of this stipulation is to permit the Owner's Agent to adjust said trench line and grade as conditions require.

I. Thrust blocks shall be installed at all fittings or angular bends of 11-1/4 degrees or larger, and greater than 12” in diameter. No thrust blocks required for lines 12” in diameter and smaller.

J. All connections to existing reclaimed water mains will be made by the SFWD. Dead ends of pipes shall be fitted with bell-flange adapters and blind flange. Connections of new pipe to existing dead ends shall incorporate a bell-flange adapter connected to the existing bell-flange adapter on the existing dead end pipe.

K. Provide locating/marking tape in the trench, continuously over the centerline of the pipe. Color-coded identification tape differentiating the reclaimed water piping from other utility lines shall be consistent throughout the project. Reclaimed water pipes shall be installed with a purple identification tape or polyethylene vinyl wrap (Pantone 512). The identification tape shall be locator-type marking tape. The tape and wrap shall be at least three inches in width, and shall have white or black printing on a purple field (Pantone 512), with the following inscription:

"RECLAIMED WATER -- DO NOT DRINK"

plus a universal icon for nonpotable water (Figure B-1, Appendix A)

Text shall not be separated by gaps of more than 6 inches. If the tape is wrapped around the pipe, there shall be two parallel rows of text so that the warning is readable after overlapping. Identification tape shall be continuous in coverage. If tape is attached to sections of pipe before they are placed in the trench, there shall be extra lengths of flaps to provide continuous coverage when the section is installed.

During pipeline installation, a 3-inch wide identification tape shall be placed in the trench 12 inches above the top of the pipe. Tape shall be oriented longitudinally, and centered along the top of the distribution line, with the printed side facing up. Necessary precautions shall be taken to insure the tape is not distorted or otherwise misplaced during backfilling operations. The intent of this tape is to provide warning during future excavation activities that reclaimed water pipeline is located below, and thus avoid damage and interruption of service.

L. Valves shall be purple. Valves shall be identified with a stamped brass or engraved plastic disc not less than 1.5 inches in diameter permanently affixed to the valve, with the inscription:

"RECLAIMED WATER"

plus a universal icon for nonpotable water (Figure B-1, Appendix A)

M. Reclaimed water pipelines shall maintain minimum separation distances from potable water pipelines in conformance with The Waterworks Standards, Title 22, Chapter 16, Section 64572. In addition, reclaimed water pipelines shall maintain the same minimum DOHS separation distances from sanitary sewer lines to prevent recontamination. Installation of pipelines in common trenches shall be prohibited.

N. The entire pipe system shall be encased with purple polyethylene tubes or sheets in accordance with AWWA C105.

O. All rubber gasket joints, fusion epoxy coated flanges and flexible couplings on ductile iron pipelines shall be bonded with insulated copper cable to insure electrical continuity of pipeline and fittings.

P. Insulating flanges and/or couplings shall be installed to electrically isolate the buried portion of pipeline from other metallic pipelines, reinforced concrete structures and above grade buildings or structures.

Q. All joints on Service Laterals shall be restrained per SFWD Standards.

3.2 IDENTIFICATION OF “FIELD-LOKTM” GASKET JOINTS

A. The Contractor shall identify all joints with “Field-LokTM” gaskets by spraying white marking paint on top of each bell and also by taping a direct burial tape around the spigot end of each pipe, just in front of the bell.

3.3 FLEXIBLE JOINT INSTALLATION

A. Flexible Expansion Joints shall be installed where located on the Project Drawings pursuant to the Manufactures installation recommendations.

3.4 HYDROSTATIC TEST IN THE FIELD

A. When the pipeline or a portion of the pipeline laid under this contract is completed, the Contractor shall test the line to a hydrostatic pressure of 225 pounds per square inch. The actual pressure test of 225 psi shall be maintained for not less than 2 hours during which time no additional water shall be added to the line under test. Unless otherwise directed by the Owner's Agent, the pipe joints shall be exposed during the test. All service lines to be incorporated in the pipeline shall be installed before the pipeline may be tested and shall be included in the test. All tests shall be witnessed by the Owner's Agent.

For testing of new pipe connected to existing pipe, the connecting bell-flange adapters shall have an 1/8" blind flange inserted between. Upon completion of the test, the blind flange shall be removed, a gasket inserted, and the flange bolts retightened, all in the presence of the City inspector.

The Contractor shall furnish all necessary labor, material and equipment, such as pumps, piping, connections, pressure gauges, etc., for the test. The Contractor shall also furnish and install necessary anchorage and blocking to prevent movement of the pipe under test.

If any section of the pipe under test develops a leak visible to the eye in the rubber gasket joints or in the pipe itself, the Contractor shall repair or replace the defective portion of the pipe as directed by the Owner's Agent at no additional cost. After all repairs are made, the pipe shall be retested.

3.5 DISINFECTION

A. Upon completion of satisfactory hydrostatic test, the Water Department may, at theirdiscretion, disinfect the main. The Water will supply and install all piping, fittings and other materials necessary to disinfect the main, except screw taps and risers, which shall be installed by the Contractor. The Contractor shall not backfill the site of such work until the satisfactory disinfection of the main is verified by the Owner's Agent, or approval is received in lieu of disinfection procedures.

3.6 INSTALLING PIPE FITTINGS

A. The Contractor shall include the procurement, placing, restraining, and protecting of all fittings, valves, joint restraints, and all other appurtenances to be incorporated in the work, all as indicated in the Contract Documents or as directed by the Owner's Agent.

B. Installation:

All fittings shall be installed in the manner specified for installing pipe under Item 3.1 unless otherwise specified herein, and as directed by the Owner's Agent.

All bends, tees, and gates of 4, 6, 8, and 12-inches in diameter shall be fastened to the pipe or to each other by use of "Field-LokTM" gaskets. Caps shall be fastened to the pipe by use of tie rods and lugs or restrainers as shown on Standard Drawing E-4969. Additional lug and tie rod joint restraints shall be installed at locations directed by the Owner's Agent.

Joints on all laterals to the main shall be restrained as required and directed by the Owner's Agent.

The Contractor shall paint all tie rods, lugs, restraining ring assembly, bands and other miscellaneous metal attached to the pipeline, installed by the Contractor during main connections, or large service connections with two (2) coats Kopper Bitumastic No. 505 or two (2) coats Protecto Wrap CA160 or approved equal, applied in accordance with the manufacturer's directions.

Installation of securing devices for fittings, such as lugs, restraining ring assembly, bands, tie rods, and other miscellaneous metal, and furnishing and application of protective painting to devices will be considered as incidental work, and no direct payment will be made therefore.

C. Valve Boxes:

Over each valve, blow-off or other similar appurtenance, a piece of ductile iron pipe of such size as may be required by the Water Department shall be place vertically to form a valve box. A cover, as detailed in Appendix A (D&L Foundry M-9009 or M-9014, as applicable) and specified in Section 3.1K, shall be placed on top of the pipe or box. The bottom of the box shall rest on a steel plate required by the Water Department so placed as to prevent the box from bearing on the gate. Steel plates supporting boxes, over blow-offs or air valves shall be set on an asphalt bed. Contractor shall cut the box to such lengths that the top of the gate cover will be flush with the surface of the finished pavement.

3.7 INSTALLING SHORING

A. Work Included:

Under this item, the Contractor shall install an approved shoring system for all excavations 5 feet or more in depth.

All shoring shall be installed in accordance with standards established by the California Division of Industrial Safety and in conformance with all other applicable rules and requirements.

If the Contractor intends to use a shoring plan which varies from the Standards established by the California Division of Industrial Safety, the plan shall be prepared and signed by a Registered Civil Engineer and submitted to the Owner's Agent for approval at least five (5) working days before the Contractor intends to begin excavating. The Contractor shall not start excavation prior to approval of the shoring plan by the Owner's Agent.

In locations where the City crews will install service lines or connections to other lines, regardless of depth, the Contractor shall install a solid sheeting type shoring system, approved by the Owner’s Agent, which is capable of protecting all excavations from excessive water that may be present and give ample access to the crews to perform the installation. This shoring system is more stringent than CAL/OSHA Standards.

All shoring materials and equipment shall be removed from the excavation prior to completion of work.

3.8 INSTALLATION OF SCREW TAPS

A. The Contractor shall drill, tap and install all screw taps and risers as indicated in the Contract Documents or as required by the Owner's Agent.

B. Installation:

Any screw taps not satisfactorily installed in the opinion of the Owner's Agent shall be removed and replaced at the expense of the Contractor. Where the screw tap installation is unsatisfactory, it shall be removed and replaced with a solid cast iron plug. The Contractor shall relocate screw taps to locations as directed by the Owner's Agent.

3.9 INSTALLATION OF SERVICE PIPE

A. The Contractor shall remove pavement; excavate service trench; provide and install service pipe and fittings; complete in place and ready for connections with service meter or existing service pipe; furnish and place backfill material in the trench; and clean the site of the work together with all other work necessary or incidental thereto.

See Appendix A, Meter Vault Details, for layout of lateral pipe and fittings.

The locations for services indicated on the drawings are subject to change as directed by the Owner's Agent.

Service pipe larger than two inches nominal diameter shall be ductile iron.

B. Service Trench Excavation and Backfill:

All work and materials included in this Item shall be in accordance with the provisions of Section 02225, "Excavation, Backfilling and Compacting for Utilities." The service trench shall be of sufficient width to properly install the service pipe and have a flat bottom of at least two feet below the gutter grade, as indicated on the Project Drawings.

The bottom of the trench shall slope uniformly to the main from a point approximately ten feet from the main.

C. Service Fittings:

Service fittings shall be flare type fittings, soldered joint type fittings, or other type fittings currently in use by Water Department. Contractor shall make cold flares by use of flaring tools approved by the Water Department whenever a flare-type fitting is furnished. Heat shall not be applied to flare tubing. Joints for other types of fittings shall be in accordance with the method recommended by the manufacturer and approved by the Water Department. Refer to Standard Drawing E-4969, Appendix A.

Provide insulating type joints to electrically separate dissimilar pipe materials where dissimilar pipes are joined.

D. Installing Service Pipe and Fittings:

The Water Department shall install service pipe connections to existing mains prior to service pipe installation. The Contractor shall install service pipe connections to all new mains. The Contractor shall install service pipe and fittings to a point inside the meter box, and thence from the meter box to one foot beyond the back of sidewalk, or as otherwise directed by the Owner's Agent. The Contractor shall coordinate with the Water Department

to confirm the flange to flange dimension for each meter installation prior to service pipe installation. The service meter will be installed and connected to the service line by the Water Department.

The Contractor shall use jacking methods to install service pipe across existing traffic lanes wherever possible. Approval of the Owner's Agent shall be obtained before any excavation for service line is permitted in the existing traffic lanes.

E. Meter Boxes:

Contractor shall procure, purchase and install meter boxes. Contractor shall purchase, procure, and install meter box covers. Contractor shall accurately locate the meter box installation in the field and confirm piping arrangement so that box and cover is integrated into the streetscape in accordance with the project drawings, landscape details. Contractor shall adjust meter box to appropriate grade and install cover. Contractor to provide excavation, stabilization material under box, and backfill.

END OF SECTION

SECTION 02536

SEPARATED STORM DRAINAGE

PART 1 - GENERAL

1.0 REFERENCE STANDARDS

A. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), Latest Edition. Also referred to as "City Standard Specifications."

B. Standard Plans of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SPDPWSF), Latest Edition. Also referred to as "City Standard Plans."

C. Department of Public Works (DPW) Order No. 178,940 "Regulations for Excavating and Restoring Streets in San Francisco."

1.1 WORK INCLUDED

A. Section includes:
   1. Installation of separated storm drain pipe, catch basins, manholes, sand traps and appurtenances.
   2. Testing

B. Comply with all other provisions of the Contract Documents.

1.2 RELATED SECTIONS

A. Section 02225, "Excavation, Backfilling and Compacting for Utilities"

1.3 QUALITY ASSURANCE

A. All testing shall be witnessed by the Owner's Agent and the City. Retesting required as a result of failed tests shall be at the Contractor's expense.

1.4 EQUIPMENT

A. Contractor shall ensure that all equipment used on this site is operated, inspected and maintained in accordance with applicable Cal/OSHA standards.

1.5 SUBMITTALS

A. Submit complete specifications, catalog information and cuts, descriptive drawings, and literature for each item to be furnished under this Section, with all exceptions to the Specifications noted. Provide submittals for:
1. Pipe (including gaskets), structures, and fittings
2. Manhole frame and cover

PART 2 - PRODUCTS

2.1 GENERAL

A. Separated storm drain pipe and structures shall be per requirements for the combined sewer system as described in Part 3 'Sewerage and Drainage' of the City Standard Specifications and as indicated in the City Standard Plans, except as modified herein or in the Project Drawings.

2.2 SEPARATED STORM DRAINAGE MATERIALS

A. Storm drain mains:

Storm drain mains 24" and smaller inside diameter, shall be HDPE SDR 17 conforming to ASTM D3035 and requirement for HDPE contained in these specifications RCP conforming to the requirements for RCP contained in these specifications.
Storm drain mains larger than 24" inside diameter, shall be Class IV~V reinforced concrete pipe (RCP), conforming to the requirements for RCP contained in these specifications.

1. Requirements for RCP:
   a. Connections of HDPE to HDPE shall be made by heat (butt) of the pipe ends, in accordance with ASTM F2620.
   b. Connection of HDPE to HDPE using Electrofusion coupling shall be approved by the City on a case-by-case basis
   c. Pipe sizes shown in Project drawings are minimum inside pipe diameters. HDPE shall have a minimum inside diameter greater than shown in plans.

2. RCP materials shall conform to the requirements of latest ASTM Class IV RCP shall have a designated D-load, to produce a 0.01-inch crack of pipe, of 2000. The D-load to produce the ultimate load shall be 3000.

   Class IV RCP shall be designed and manufactured with concrete strength at 5000 psi with minimum wall B design.

   Class V RCP shall have a designated D-load to produce a 0.01-inch crack of pipe shall be 3000. The D-load to produce the ultimate load shall be 3750. Class V RCP shall be designed and manufactured with concrete strength at 6000 psi with minimum wall B design.

The RCP shall be spun pipe. Concrete shall have a minimum slump of 2 ½ inches and pipe shall remain in the form for a minimum of 6 hours. Dry cast pipe will not be allowed. Cement shall be Type II conforming to ASTM C150.

3. All RCP shall be designed and manufactured with minimum wall B Design. For all RCP, double circular steel reinforcements shall be provided. The area of the outer cage steel reinforcement shall not be less than 75 percent of the inner cage. Design calculations shall be submitted for approval.

    a. For Class IV RCP: No wire fabric/mesh or welded wire design shall be allowed.
    b. For Class V RCP: No wire fabric/mesh or welded wire design shall be allowed unless use of welded wire mesh is accepted by the SFPUC on a case-by-case basis.

4. For rebar design, no less than 12 longitudinal bars at approximately equal spacing shall be provided for each cage. A minimum 3/8-inch diameter size shall be used for the longitudinal bars.

5. A minimum 1-1/2 inches concrete covering over reinforcing steel from the outside and one inch from the inside surface of the pipe shall be provided.

6. All pipe-to-pipe connections shall be of a watertight bell/spigot connection. Joints of RCP shall be of Deep Bell (Flared Bell) with gasket type. All pipe-to-pipe connections shall be of a watertight bell/spigot connection. No cast-in-place joint connections will be allowed. RCP pipe joints shall have Neoprene rubber gasket.

B. Flexible Joints and Couplings:

Flexible Joints for RCP shall consist of couplings or standard bell and spigot joints with Neoprene rubber gaskets.

Couplings shall consist of a fabricated steel coupling joining two ends of pipe meeting provisions of ANSI/AWWA C219-97 and having the following characteristics:

a. Middle ring of ASTM A36, min. yield 36k psi
b. Follower rings of ASTM A576/ASTM A36
c. Gaskets of NSF-61 Buna-S/SBR/Gr. 30/Gr. 27 per ASTM D2000/AWWA C-111/C-219
d. Bolts of Type 316 SST w/ heavy hex nuts
e. Lining and Coating of NSF 61 Fusion Bonded Epoxy, 12 mils min. dft applied per AWWA C-213
f. Baker Coupling Series 200/212, Romac Series 400, or approved equal.
g. Paint cut ends of RCP with epoxy paint to protect exposed reinforcement.

C. Pipes for service laterals and culverts shall be HDPE SDR 17 and shall connect to the main as shown on the Project Drawings.

D. Fittings for cleanouts shall be ductile iron pipe with Neoprene rubber gaskets. Cleanout boxes shall be Christy G5 Box with G5C lid and vandal resistant hold-down option, marked with appropriate utility description.

E. Manhole frame and cover shall be D&L Foundry A-1024 or South Bay Foundry SBF 1900 CPH. Manhole covers for separated storm drain manholes shall be marked "STORM DRAIN".

F. Perforated pipe for tree trench drains and flow-through planter sub-drains shall be 4" diameter dual wall polyethylene (PE) pipe. All perforations shall be slotted type and conform to AASHTO Class II specifications and measure 0.125 inch thick by 0.875 inch long, providing a minimum inlet area of 1.0 square inch per linear foot of pipe. For tree trench drains beyond the limits of structural soil, drain pipe shall be non-perforated pipe meeting the same specification. Fittings shall match strength of pipe.

G. Catch basins and bicycle-proof grates shall be as shown on Project Drawings.

H. Flared end sections shall be precast concrete.

I. Manhole bases may be precast concrete as approved by Owner's Agent and CCSF. Walls shall be constructed to avoid pipes entering within 8" of wall joints. Precast bases must be filled and formed with lean concrete to provide smooth channels connecting inlet and outlet pipes.

J. Elastomeric bearing pads used at pipe-to-manhole connections per CCSF Standard Plan 87,182 may be substituted with Hydrotite DSS-0420, or accepted equal.

2.3 STORM DRAIN FLAP VALVE

A. Valve to be Coplastisx model GP-15 flap valve with stainless steel frame work and Coplastix flap seal, by Ashbrook Simon-Hartley, or accepted equal.

2.5 STORM DRAIN CHECK VALVE

A. Valve to be Tideflex CheckMate, Tideflex TF-1 ONYX Valve Series DBRS Reverse Slip-In Check Valve, or approved equal.

2.6 SERVICE SADDLE & SETTLEMENT MONUMENT

A. Service saddles shall be JCM 406 Coated Service Saddle with Double Stainless Steel Straps, Romac Industries, Inc. 305-H or 306-H, or Smith-Blair 317 TaperSeal Service Saddle with spring washers, or equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of storm drainage pipe and structures shall conform to requirements of Part 3, 'Sewerage and Drainage', of the City Standard Specifications.

3.2 STORM DRAIN FACILITIES

A. The invert slope of the pipe shall be uniform between two sewer structure invert/keys elevations. Field adjustment of the slope may be necessary after verification by the contractor of the invert/keys elevations of sewer pipes or sewer structures. The descending order of precedence shall be as follows:

1. Invert Elevation
2. Invert Conform Elevation
3. Slope
4. Existing Elevation
5. Approximate Elevation

B. Flexible Joints:

1. Flexible Joints shall be installed at each manhole connection as shown on SPDPWSF File No. 87,181, 87,182, and 87,183. Flexible Joints are not required at HDPE pipe-to-manhole connections.

2. Additional flexible joints shall be installed where indicated on the Construction Documents.

C. Contractor shall provide a bypass plan for review and approval by CCSF for connection to any existing combined sewer or storm drain main.

D. At catch basins, connection of the 10" storm drain lateral to the cast iron trap shall be made with rubber a compression coupling meeting the requirements of ASTM C425, incorporating grade 316 stainless steel band clamps.

E. All new work including manholes shall be tested at no additional expense to Owner or City.

Low pressure testing shall be in conformance with City Standard Specifications, Section 319, with 72 hours advance notice to Owners Agent and the City.

HDPE pipe shall be tested in conformance with ASTM F 1417-92 "Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air."

All manholes shall be vacuum tested and shall meet the requirements of ASTM C1244 prior to acceptance. Manholes shall be tested prior to backfill. The contractor may propose, in writing, to test manholes after backfill. If approved by the Owner's Agent, in writing, manholes may be tested after backfill is complete. However, should the manholes fail the vacuum test after backfill has occurred, the contractor shall be responsible for any and all costs associated with the re-excavation of the manholes in order to perform repairs or warranty work and the cost of retesting.

F. Provide video inspection by an approved television video inspection service in accordance to Appendix A at no cost to Owner or City. Contractor shall perform post-construction video inspection of existing laterals and existing connecting mains (e.g. side sewers and culverts) up to vents and/or catch basins within the public right-of-way for submittal to City for review. If lateral or connecting main is shown to be inoperable, Contractor to replace with new. Replacement work shall be done under separate Change Order unless damage is shown to be caused by Contractor. The contractor is responsible for obtaining asset numbers for all new and existing manholes and pipes from Mr. Alan Liu, SFPUC Sewer Operations, aliu@sfwater.org / 415-641-2372, 160 Napoleon Street, San Francisco, CA 94124, by advance appointment between the hours of 6:30 AM and 3:00 PM Monday through Friday.

G. All HDPE pipe 12" or greater shall be deflection tested. Maximum installed deflections of HDPE pipe shall be five percent (5%) of mean internal diameter. Pipe exceeding deflection limits shall be replaced or re-compacted at contractor's expense.

Any main that appears to be not installed at line and grade shall be mandrel tested at no additional cost to the City. Contractor shall provide mandrel deflection testing equipment and labor. Mandrel shall be submitted for review and approval by the City prior to use. Mandrel shall be rigid.

H. No repairs shall be undertaken without prior written notice and repair proposal to Owners Agent and the City.

I. For installations using HDPE pipe, the bead formed when sections of pipe are joined shall be immediately removed from the interior of the pipe per Manufacturers recommendations.

J. Supply one additional manhole cover for each sub-phase or 10% of the total manhole covers in each sub-phase, whichever is greater.

END OF SECTION

SECTION 02537

SEPARATED SANITARY SEWER

PART 1 - GENERAL

1.0 REFERENCE STANDARDS

A. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), Latest Edition. Also referred to as "City Standard Specifications."

B. Standard Plans of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SPDPWSF), Latest Edition. Also referred to as "City Standard Plans."

C. Department of Public Works (DPW) Order No. 176,707 "Regulations for Excavating and Restoring Streets in San Francisco", approved March 26, 2007.

D. City and County of San Francisco Plumbing Code.

1.1 WORK INCLUDED

A. Section includes (but is not necessarily limited to):
1. Installation of sanitary sewer main.
2. Installation of sanitary side sewer, building sewer and building drain to the property line.
3. Testing

B. Comply with all other provisions of the Contract Documents.

1.2 RELATED SECTIONS

Section 02225, "Excavation, Backfilling and Compacting for Utilities"

1.3 QUALITY ASSURANCE

A. All testing required shall be witnessed by the Owner's Agent and the City. Retesting required as a result of failed tests shall be at the contractor's expense.

1.4 EQUIPMENT

A. Contractor shall ensure that all equipment used on this site is operated, inspected and maintained in accordance with applicable Cal/OSHA standards.

1.5 SUBMITTALS

A. Submit complete specifications, catalog information and cuts, descriptive drawings, and literature for each equipment item to be furnished under this Section, with all exceptions to the Specifications noted. Provide submittals for:
   1. Pipe, Structures, and Fittings
   2. Manhole frames and covers
   3. Settlement monument ring and cover

PART 2 - PRODUCTS

2.1 GENERAL

A. Sanitary sewer structures, pipes, fittings, and materials shall be per requirements of Part 3, 'Sewerage and Drainage', of the City Standard Specifications and the City Standard Plans, except as modified herein.

2.2 PIPE MATERIAL

A. Sanitary sewer mains:

   1. Sanitary sewers 6” to 24” inside diameter shall be High Density Polyethylene (HDPE), ASTM D3035, with SDR of 17.

B. Sanitary sewer laterals: Sanitary sewer laterals shall be HDPE with SDR equal to main sewers, from main or manhole to P-trap. P-trap shall be cast iron pipe. Vent riser shall be HDPE with SDR equal to main sewers. Provide calder type coupling before trap to connect dissimilar pipes. Sanitary Sewer vents shall be 4” diameter minimum and cover shall be 6”x6” cast iron sidewalk vent box with perforated steel plate lid, as available from CalSteam, San Francisco, CA.

C. Connections of HDPE to HDPE shall be made by electrofusion of the pipe ends, the use of electrofusion couplings, or heat fusion in accordance with ASTM F2620.

D. Service laterals shall connect to new mains with standard factory made tee fittings.

E. Submittals for type of pipe and fittings to be reviewed and approved by Owner’s Agent and submitted to DPW/ITF for City review and approval.

2.3 MANHOLES AND CLEANOUTS

A. Manholes and cleanouts shall conform to the City Standard Plans and Specifications.

B. Manhole lid frame and cover shall be D&L Foundry Model A-1024 or South Bay Foundry Model SBF 1900. Cover shall be marked “Sanitary Sewer”.

C. Elastomeric bearing pads used at pipe-to-manhole connections per CCSF Standard Plans may be substituted with Hydrotite DSS-0420, or approved equal.

2.4 SERVICE SADDLE & SETTLEMENT MONUMENT

A. Service saddles shall be JCM 406 Coated Service Saddle with Double Stainless Steel Straps, Romac Industries, Inc. 305-H or 306-H, or Smith-Blair 317 TaperSeal Service Saddle with spring washers, or equal.

B. Settlement monument ring and cover shall be D&L Foundry & Supply Model Number K-6001-2 or equal. Identify settlement monument with “SANITARY SEWER”.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of sanitary sewers and structures shall conform to requirements of Part 3, 'Sewerage and Drainage', of the City Standard Specifications.

B. Installation of sewer lateral connection shall be per section 316 of City Standard Specifications and Standard Plan File No. 87,196 & 87,197.

C. Where the street is to be paved before lot improvements are made, sewer lateral must be constructed beyond the curb and to the back of sidewalk before the paving is started. The upper end of each side sewer not in service when the work is backfilled shall be closed with a stopper, marked with a redwood post, and marked with the letter “S” on the curb.

D. Openings in the existing sanitary sewer main shall be made with a sharp cutting tool, and an approved saddle of appropriate size shall be epoxied or strapped to the sewer main.

E. Contractor shall provide bypass plan for review and approval by CCSF for connection to any existing Combined Sewer or Separated Sanitary Sewer main.

F. All new work including manholes shall be tested at no additional cost to Owner or City.

Testing shall be in conformance with City Standard Specifications, Section 319, with 72 hours advance notice to Owners Agent and the City. HDPE pipe shall be tested in conformance with ASTM F 1417-92 “Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.”

All manholes shall be vacuum tested and shall meet the requirements of ASTM C1244 prior to acceptance. Manholes shall be tested prior to backfill. The contractor may propose, in writing, to test manholes after backfill. If approved by the Owner’s Agent, in writing, manholes may be tested after backfill is complete. However, should the manholes fail the vacuum test after backfill has occurred, the contractor shall be responsible for any and all costs associated with the re-excavation of the manholes in order to perform repairs or warranty work and the cost of retesting.

G. In addition to above testing, provide video inspection by an approved television video inspection service in accordance to Appendix B at no cost to Owner or City. Contractor to perform post-construction video inspection of existing laterals and existing connecting mains (e.g. side sewers and culverts) up to vents and/or catch basins within the public right-of-way for submittal to City for review. If lateral or connecting main is shown to be inoperable, Contractor to replace with new. Replacement work to be done under separate Change Order unless damaged is shown to be caused by Contractor. The contractor is responsible for obtaining asset numbers for all new and existing manholes and pipes from Mr. Alan Liu, SFPUC Sewer Operations, aliu@sfwater.org / 415-641-2372, 160 Napoleon Street, San Francisco, CA 94124, by advance appointment between the hours of 6:30 AM and 3:00 PM Monday through Friday.

H. No repairs shall be undertaken without prior written notice and repair proposal to Owner's Agent and the City.

I. All HDPE pipe 12" or greater shall be deflection tested. Maximum installed deflections of HDPE pipe shall be five percent (5%) of mean internal diameter. Contractor shall provide mandrel deflection testing equipment and labor. Pipe exceeding deflection limits shall be replaced or re-compacted at contractor's expense.

Any main that appears to be not installed at line and grade shall be mandrel tested at no additional cost to the City. Mandrel shall be submitted for review and approval by the City prior to use. Mandrel shall be rigid.

J. For installation using HDPE pipe, the bead formed when sections of pipe are joined shall be immediately removed from the interior of the pipe per Manufacturers recommendations.

K. Supply one additional manhole cover for each sub-phase or 10% of the total manhole covers in each sub-phase, whichever is greater.

END OF SECTION

SECTION 02580

SIGNING, PAVEMENT MARKINGS, AND CURB PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. All permanent traffic signs and pavement markings to be used in the public right-of-way (ROW) shall be furnished and installed by CCSF. The installation cost of the final traffic signs and pavement markings will be paid for by the owner.

B. All temporary traffic signs and pavement markings to be utilized in the public ROW shall be furnished and installed by the contractor in accordance with Section 01570 of these Specifications and as directed by the Owner's Agent. All temporary signing and work completed as part of this article shall be considered part of Section 01570 "Traffic Routing Work" and no separate payment will be made thereafter.

C. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division l of these Specifications

1.2 QUALITY ASSURANCE AND APPLICABLE STANDARDS

A. The following reference is hereby made part of this Specification and all work of this Section shall conform to the requirements therein, except as herein modified.

1. California Vehicle Code

2. San Francisco Municipal Code, Chapter XI- Traffic Code

3. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), Latest Edition. Also referred to as "City Standard Specifications."

4. Caltrans Standard Specifications (CTSS) and Caltrans Standard Plans (CTSP) except as modified herein.

5. Manual of Traffic Controls for Construction and Maintenance Work Zone, Department of Transportation, State of California

6. Regulations for Working in San Francisco Streets, ("Blue Book"), DPT, CCSF

7. Work Area Traffic Control Handbook, BNI Books

8. In case of conflict between State Standard Specifications and this Specification, this Specification governs.

B. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work.

PART 2 - PRODUCTS

2.1 TEMPORARY SIGNING AND PAVEMENT MARKING IN THE PUBLIC ROW

C. Provide all materials in accordance with the requirements of Section 01570 of these Specifications.

PART 3 - EXECUTION

3.1 GENERAL

A. Provide all materials and execute all work in accordance with the requirements of Section 01570 of these Specifications.

3.2 APPLICATION OF PAVEMENT MARKINGS

A. Where existing pavement markings or traffic lines have become damaged or hard to read as a result of the construction, said pavement markings and traffic lines shall be removed and replaced by CCSF at the contractor's expense.

3.3 CURB PAINTING

A. Curb painting, where indicated, will be provided by CCSF forces, and shall be considered included in the City's (DPT's) Statement of Costs with no additional expense to the Contractor.

END OF SECTION

SECTION 02740

ASPHALT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. Plant-mixed asphalt concrete pavement and other asphaltic concrete items for paving of new road works.
   2. Concrete Pavement

1.2 QUALITY ASSURANCE

A. The following references are hereby made a part of this Specification and all work of this Section shall conform to the requirements therein, except as herein modified.
   1. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF**),** latest edition. Also referred to as "City Standard Specifications."
   2. Caltrans Standard Specifications (CTSS) and Caltrans Standard Plans (CTSP), latest editions. Delete all references to statistical testing and measurement and payment.
   3. Department of Public Works (DPW) Order No. 178,940 "Regulations for Excavating and Restoring Streets in San Francisco".
   4. In case of conflict between State Standard Specifications and this Specification, this Specification governs.

B. Contractor shall be responsible for materials mix design.

1.3 SUBMITTALS

A. Contractor shall submit information to substantiate compliance with this Specification. Minimum information submitted shall include a manufacturer's certification for asphalt products and an asphalt concrete mix designed by an independent, qualified laboratory. Production of asphaltic concrete for this Project shall not begin until the materials and the mix design have been reviewed and accepted by the Owner's Agent.

PART 2 – PRODUCTS

2.1 ROAD PAVEMENT

A. Aggregates for asphaltic concrete shall conform to the requirements of Section 212.03 of the City Standard Specifications, maximum 1/2-inch size. In accordance with Caltrans 2010 SSP 39-1.02E (or latest version thereof), Contractor may substitute reclaimed asphalt pavement (RAP) aggregate for a portion of the virgin aggregate in asphalt concrete in an amount not exceeding 15% of the aggregate blend.

B. Asphaltic Materials:
   1. Asphalt Cement: Section 92 of CTSS, Grade PG 64-10, for use as binder in the asphalt mixture. Amount of asphalt cement shall be based on mix design.
   2. Paint Binder: as per Section 212.06 of the City Standard Specifications.

D. Aggregate Base: Conform to Section 205 of the City Standard Specifications.Reclaimed materials may be incorporated in accordance with Caltrans Standard Specifications, 26-1.02A & B.

E. Concrete Pavement: Conform to Section 210 of the City Standard Specification. In accordance with Section 03300 2.4, recycled concrete shall be used.

PART 3 – EXECUTION

3.1 PROTECTION

A. Concrete walks, curbs and other improvements adjacent to construction shall be protected.

Contractor shall be responsible for damage caused by his employees or equipment and shall make necessary repairs at no additional cost to the owner. Buildings and other surfaces shall be covered with paper or other protection, where required, as approved by the Owner's Agent at no additional cost to the Owner.

3.2 CONFORM AREAS

A. Where new paving is adjacent to existing pavement, the conform areas shall be treated per the requirements of Section 212.10 of the City Standard Specifications.

3.3 SURFACE PREPARATION

A. Prior to commencing overlay operations, all existing pavement shall be prepared in conformance with the requirements of Part 2 of the City Standard Specifications.

3.4 CONCRETE PAVEMENT

A. Installation shall conform to Section 210 of the City Standard Specification, except that as an alternate to placing concrete using a self-propelled paving machine, concrete base may be installed using the following method: Tailgating the concrete, vibrating the concrete with a High Cycle gas or electric powered concrete vibrator, screeding by hand, several passes by hand with a wooden bull float, wet-setting of 1/2" joint filler material every 15 foot on center, and a final pass with a waffle roller to give the concrete surface a uniform, non-skid surface to enhance adhesion of the AC.

3.5 ASPHALT CONCRETE

A. Asphalt concrete base, subbase, leveling course, and wearing surfaces shall be placed and spread in accordance with the requirements of Part 2, City Standard Specifications.

B. Where new pavement is to be placed over existing pavement, the existing pavement shall first be planed in conformance to the requirements of Section 214 of the City Standard Specifications.

3.5 CONCRETE PAVEMENT

A. Installation shall conform to Section 210 of the City Standard Specification, except that as an alternate to placing concrete using a self-propelled paving machine, concrete base may be installed using the following method: Tailgating the concrete, vibrating the concrete with a High Cycle gas or electric powered concrete vibrator, screeding by hand, several passes by hand with a wooden bull float, wet-setting of 1/2" joint filler material every 15 foot on center, and a final pass with a waffle roller to give the concrete surface a uniform, non-skid surface to enhance adhesion of the AC.

3.6 ADJUSTMENT OF MANHOLE FRAMES AND OTHER CASTINGS

A. The Contractor shall comply with Section 217 of the San Francisco Department of Public Works Standard Specifications concerning adjustment of frames and castings.

B. The Contractor shall adjust all manholes and/or castings including, but not limited to, those owned by the Department of Public Works, Department of Telecommunications and Information Service, Police Department, Fire Department, Water Department, and Public Utilities Commission.

C. The Contractor will be assessed $1000 for each manhole and/or castings left buried after seven (7) calendar days.

END OF SECTION

SECTION 02810

IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Order and furnish all labor, materials, supplies, tools and transportation and perform all operations in connection with and reasonably incidental to complete installation of the automatic irrigation systems as indicated in the Contract Documents. Items hereinafter are included as an aid to pricing, and are not necessarily a complete list of work items.

1. Trenching, stockpiling, excavation, backfill materials and refilling trenches.
2. Furnishing materials and installation for complete system including piping, backflow prevention assembly, valves, fittings, irrigation heads, automatic controls and final adjustment of heads to insure complete and uniform coverage.
3. Line voltage connections to the irrigation controllers and low voltage control wiring from controllers to remote control valves.
4. Replacement of unsatisfactory materials.
5. Clean-up
6. All work of every description mentioned in the specification and/or addenda thereto, and all other labor, and materials reasonably incidental to the satisfactory completion of the work, including clean up of the site, as directed by the Owner's Agent.
7. Tests.
8. Record drawings.
9. Maintenance and Warranty Period

B. Work Not Included:

1. Irrigation water meter and service line.
2. 120 volt A.C. electrical stub-out to controller location.

C. Related Sections:

1. Section 02920 – Structural Soil
2. Section 02935 - Landscape Maintenance and Warranty
3. Section 02950 - Tree Planting
4. Section 02952 - Shrub Planting
5. Section 02953 - Lawns

1.2 GENERAL REQUIREMENTS

A. OSHA Compliance: All articles and services covered by this specification shall meet or exceed the safety standards established by Cal/OSHA, together with all amendments in effect as of the date of this specification.

Codes and Standards: Comply with all applicable codes and standards.

1. All work and materials shall be in full accordance with the latest rules and regulations of the National Electric Code; the Uniform Plumbing Code, published by Western Plumbing Officials Association; and other State or local laws or regulations. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes.
2. When the specifications call for materials or construction of a better quality or larger size than required by the above mentioned rules and regulations, the provision of the specifications shall take precedence over the requirements of the said rules and regulations.
3. The Contractor shall furnish, without any extra charge, any additional material and labor when required by the compliance with these rules and regulations, though the work be not mentioned in these particular specifications or shown on the drawings.
4. The Contractor shall erect and maintain barricades, guards, warning signs and lights as necessary or required by Cal/OSHA regulations for the protection of the public or workmen.
5. Any existing buildings, equipment, piping, pipe covering sewers, sidewalks, landscaping, etc., damaged by the Contractor during the course of this work shall be replaced or repaired by the Contractor in a manner satisfactory to Owner's Agent and at Contractor's expense, and before final payment is made. The Contractor shall be responsible for damage caused by leaks in the piping systems being installed or having been installed by him. He shall repair, at his own expense, all damage so caused, in a manner satisfactory to Owner's Agent.

1.3 SUPERVISION AND WORKMANSHIP

A. The Contractor, personally or through an authorized and competent representative, shall supervise the work constantly, and shall as far as possible keep the same foreman and workmen on the job from commencement to completion. The workmanship of the entire job must in every way be first class, and only experienced and competent workmen will be allowed on the job.

1.4 LAYOUT OF WORK

A. The Contractor shall stake out the irrigation system as shown on the drawings. These areas shall be checked by the Contractor and Owner's Agent before construction is started. Any changes, deletions or additions shall be determined at this check.

1.5 INSTRUCTION

A. After the system has been installed and approved, the Contractor shall instruct the Owner's Agent in complete operation and maintenance of the irrigation system.

1.6 SUBMITTALS

A. Substitutions: Submit 6 copies of catalogue information on materials that are to be proposed for substitution. No substitution will be permitted without prior written approval by the Owner's Agent. Complete material list shall be submitted prior to performing any work.

1.7 MAINTENANCE PERIOD

A. Contractor shall provide maintenance for the irrigation system installed under this Contract from beginning of work until end of Maintenance and Warranty Period.

B. Maintenance of system includes, but is not limited to: flushing system and adjusting heads, providing optimum amounts of water to plants, replacing lost, stolen or damaged equipment, reprogramming controller, and hand watering as required for plant establishment.

1.8 WATER AUDIT

A. See Section 02935 “Landscape Maintenance and Warranty” for performance of water audits.

1.9 WARRANTY PERIOD

A. Contractor shall provide a one-year guarantee for Work of this Section.

On Contractor’s letterhead:

1. Warrant that irrigation system has been installed according to Drawings and specifications, and that system will be free of defects in products and installation for 1 year from Final Acceptance. Manufacturer’s warranties shall only supplement this warranty.
2. Agree to repair or replace defective work, or adjacent work that is damaged by such defects, with the exception of ordinary wear and tear**,** abuse or neglect. This includes damage to site improvements caused by settlement of improperly compacted trench backfill. When the specifications call for materials or construction of a better quality or larger size than required by the abovementioned rules and regulations, the provision of the specifications shall take precedence over the requirements of the said rules and regulations.
3. Owner reserves the right to make temporary repairs as required.

PART 2 - MATERIALS

2.1 PIPE AND FITTINGS

A. Main lines (constant pressure) including 2” and smaller shall be PVC 1120-Schedule 40 plastic pipe.
   1. Use Schedule 40 PVC solvent weld couplings on Schedule 40 pipe.
   2. All main line piping shall be PW Pipe “PW Purple Plus” or approved equal for use w/recycled water systems..
   3. At changes in direction or branch mains, use appropriate Schedule 40 PVC solvent weld fittings as approved by the Uniform Plumbing Code.

B. Lateral lines (non-pressure): 3/4" and larger shall be 1120-Schedule 40 PVC plastic pipe. All lateral lines shall be connected with Schedule 40, Type I, Grade I, PVC solvent weld fittings. All lateral piping shall be PW Pipe “PW Purple Plus” or approved equal for use w/recycled water systems.

C. Connections between main lines and RCV's shall be of Schedule 80 PVC (threaded both ends) nipples and fittings.

D. Risers shall be as follows: Schedule 80 PVC threaded nipples and Schedule 80 PVC ells as indicated. Offset risers shall be Cobra connector Model CC-600 (1/2"x6"). Risers shall be purple pipe.

E. Sleeves: All piping running under a roadway or driveway shall be installed in 14 gauge asphalt coated corrugated galvanized steel pipe. Piping running under all other paving shall be installed in 1120-CL. 200 PVC Plastic Pipe. All sleeves shall be two sizes larger than the irrigation piping. Length of sleeve shall overhang a minimum of 5 feet on each side of the roadway.

2.2 QUICK COUPLING VALVES

A. Quick coupling valves shall be as listed on the drawings. All valve caps shall be purple or clearly labeled with permanent tag to indicate reclaimed water.

2.3 CONTROLLERS

A. Controllers, and controller enclosures, shall be as listed on the drawings.

2.4 REMOTE CONTROL VALVES

A. Remote control valves shall be globe pattern with plastic body and bonnet, brass flow stem and manual bleed petcock. Sizes of remote control valves shall be as indicated on drawings.

2.5 GATE VALVES

A. 2 1/2" and smaller gate valves shall be bronze construction with operating wheel and screwed connections.
   1. Install in 9" diameter plastic valve box as detailed.

2.6 CONTROL WIRE

A. Control wire shall be solid copper with U.L. approval for direct burial in ground, size #14AWG Common ground wire with a jacketed 2-conductor. Preferred wore make and model is the Paige irrigation wire, spec P7350D. Control wire servicing remote control valves shall be size #14AWG with 2-conductor. Preferred male and model is the Paige irrigation wire, spec P7351D. Splices shall be made with 3M-DBY/Y-6 seal packs.

2.7 DETECTION WIRE:

A. Bare copper wire #12 or greater.

2.8 BOXES FOR REMOTE CONTROL VALVES

A. Christy model B9X Box reinforced concrete valve box with reinforced concrete lid model

B9XD.

1. Christy model B9 with cover as indicated on the drawings and details.
2. Valve boxes shall be purple or clearly labeled with permanent tag to indicate reclaimed water.

2.9 IRRIGATION HEADS

A. All heads shall be as listed on the drawings.

2.10 BACKFLOW PREVENTION DEVICE

A. Backflow prevention device shall be the reduced pressure type with gate valves, check valves, test cocks, reduced pressure chamber and air vent in metal enclosure specified on the drawings. Install 12" above finish grade.

B. Stainless steel enclosure.

2.11 MISCELLANEOUS INSTALLATION MATERIALS

A. Solvent cement and primer for solvent weld joints shall be of make and type approved by manufacturer of pipe and fittings. Cement shall be maintained at proper consistency throughout use.

B. Pipe joint compound shall be non-hardening, non-toxic materials designed specifically for use on threaded connections in water carrying pipe. Performance shall be same as Permatex No.51.

2.12 MISCELLANEOUS EQUIPMENT

A. Provide to the Owner, at completion of the maintenance period, three (3) each of all operating and servicing keys and wrenches required for complete maintenance and operation of all heads and valves. Include all wrenches necessary for complete disassembly of all heads and valves.

PART 3 - INSTALLATION

3.1 PREPARATION

A. Schedule and coordinate placement of materials and equipment in a manner to effect the earliest completion of work in conformance with construction and progress schedule.

3.2 HANDLING AND STORAGE

A. Protect work and materials from damage during construction and storage.

B. Handle plastic pipe carefully; protect from prolonged exposure to sunlight from vendor to job site.

3.3 LAYOUT

A. Layout work as accurately as possible in accordance with diagrammatic drawings.

B. Where site conditions do not permit location of piping, valves and heads where shown, notify Owner's Agent immediately and determine relocation in joint conference.

C. Run pipelines and automatic control wiring in common trenches wherever practical.

3.4 EXCAVATION AND TRENCHING

A. Excavation shall be in all cases ample in size to permit the pipes to be laid at the elevations intended and to permit ample space for joining.

B. Make trenches for pipelines deep enough to provide minimum cover from finish grade as follows:
   1. 24" minimum cover over main lines to control valves and quick coupling valves. Install purple recycled water warning tape 6” above all mainlines.
   2. 24" minimum cover over control wires from controller to valves.
   3. 18" minimum cover over RCV controlled lateral lines to heads.

C. Restore surfaces, existing underground installations, etc., damaged or cut as a result of excavations, to original conditions in a manner approved by Owner's Agent.

D. Where other utilities interfere with irrigation trenching and pipe work, adjust the trench depth as instructed by Owner's Agent.

3.5 ASSEMBLING PIPELINES

A. All pipes shall be assembled free from dirt and pipe scale. Field cut ends shall be reamed only to full pipe diameter with rough edges and burrs removed.

B. Solvent Weld Joint:
   1. Prepare joint by first making sure the pipe end is square, then de-burring the pipe end and cleaning pipe and fitting of dirt, dust and moisture.
   2. Dry-insert pipe into fitting to check for incorrect sizing. Pipe should enter fitting 1/3 to 2/3 depth of socket.
   3. Coat the inside socket surface of the fitting and the male end of the pipe with P-70 primer (manufactured by Weld-On). Then without delay, apply Weld-On 711 cement liberally to the male end of the pipe and also apply 711 cement lightly to the inside of the socket. At this time, apply a second coat of cement to the pipe end.
   4. Insert pipe immediately into fitting and turn 1/4 turn to distribute cement and remove air bubbles. The pipe must seat to the bottom of the socket and fitting. Check alignment of the fitting. Pipe and fitting shall be aligned properly without strain to either.
   5. Hold joint still for approximately thirty (30) seconds and then wipe the excess cement from the outside of the pipe and fitting.
   6. Cure joint a minimum of thirty (30) minutes before handling and at least six (6) hours before allowing water in the pipe.

C. Threaded Joint:
   1. Field threading of plastic pipe or fittings is not permitted. Factory-formed threads only will be permitted.
   2. Factory made nipples shall be used wherever possible. Field cut threads in metallic pipe will be permitted only where absolutely necessary. When field threading, cut threads accurately on axis with sharp dies.
   3. All threaded joints shall be made up with joint compound. Apply compound to male threads only.
   4. Where assembling metallic pipe to metallic fitting or valve, not more than three (3) full threads shall show when joint is made up.
   5. Where assembling to threaded plastic fitting, take up joint no more than one full turn beyond hand tight.
   6. Where assembling soft metal (brass or copper) or plastic pipe, use strap type friction wrench only; do not use metal-jawed wrench.

D. Cap or plug openings as pipeline is assembled to prevent entrance of dirt or obstructions. Remove caps or plugs only when necessary to continue assembly.

E. Where pipes or control wires pass through sleeves, provide removable non-decaying plug at ends of sleeve to prevent entrance of earth.

3.6 REMOTE CONTROL VALVES

A. Install where shown on drawings and group together where practical. Limit one remote control valve per box. No exceptions.

B. Provide 12" between valve boxes where valves are grouped together.

C. Thoroughly flush main line before installing valve.

D. Fill bottom of valve box with 3/4” pea gravel

E. Use aluminum tag to label and number each valve.

3.7 AUTOMATIC CONTROL WIRE

A. Run lines along mains wherever practical. Tie wires with pipe wrapping tape at 10’ intervals and allow slack for contraction between strappings.
B. Loop a minimum of three (3) feet of extra wire in each valve box; both control wire and ground wire.
C. Connections shall be made by crimping bare wires with brass connectors and sealing with watertight resin sealer packs.
D. Splicing will be permitted only on runs exceeding 2500’. Locate all splices at valve locations within valve boxes.
E. Where control lines pass under paving, they shall pass through Schedule 40 electrical PVC conduit. Do not tape wire in bundles inside conduit.
F. Decoder grounding shall be provided every 600 feet and every spur over 50 feet and at the end of communication path. Ground with an eight foot grounding rod. Include a Baseline BL-LA01 surge arrestor at each grounding location. Use a

split bolt connection to connect the surge device to the ground wire with a DBM waterproof connector.

3.8 DETECTION WIRE:

A. Install bare copper wire on top of the main supply line for the purpose of future mine detection search.

3.9 AUTOMATIC CONTROLLER

A. Provide and install automatic irrigation controller in metal enclosure in approximate locations shown on drawings. The exact location will be determined on the site by the Owner's Agent. Provide conduit and wire and connect to 120 volt switch accessible to controller for ease of maintenance.

B. Connect control lines to controller in sequential arrangement according to assigned identification number on valve.

3.10 BUBBLER HEADS AND QUICK COUPLING VALVES

A. Thoroughly flush lines before installing bubblers or Quick Coupling Valves.

B. Locate bubblers and Quick Coupling Valves as shown.

3.11 TESTING

A. Perform test as specified below. Remake any faulty joints with all new materials. Use of cement or caulking to seal leaks is absolutely prohibited. The Contractor shall:
   1. Notify Owner's Agent at least three (3) days in advance of testing.
   2. Perform testing at their expense.
   3. Center load piping with small amount of backfill to prevent arching or slipping under pressure. No fitting shall be covered.
   4. Apply the following tests after welded plastic pipe joints have cured at least 24 hours.
      a. Test live (constant pressure) and QCV lines hydrostatically at 125 PSI minimum. Lines will be approved if test pressure is maintained for six (6) hours. The lines shall be restored to the original test pressure and the amount of water required to do so shall be measured. Approved tables of allowable loss will be consulted, and the line will be approved or not approved as such results may indicate. The Contractor shall make tests and repairs as necessary until test conditions are met.
      b. Test lateral lines with water at line pressure and visually inspect for leaks. Retest after correcting defects.
      c. Minimum acceptable distribution uniformity shall be +/- 20%. Weather permitting, test system during windy as well as calm periods. Do not perform tests on rainy days.

3.12 BACKFILLING

A. Backfill only after piping has been tested, inspected and approved.

B. Backfill per requirements of specification Section 02225.

C. All pipe under asphalt paving shall be backfilled with 4" of clean sand on all sides of pipe.

D. Dress off areas to finish grades and remove excess soil, rocks or debris remaining after backfill is completed.

E. If settlement occurs along trenches, and adjustments in pipes, valves and sprinkler heads, soil, sod or paving are necessary to bring the system, soil, sod or paving to the proper level or the permanent grade, then the Contractor, as part of the work under this contract, shall make all adjustments without extra cost to the Owner.

3.13 CLEAN-UP

A. When work of this section has been completed and at such other times as may be directed, remove all trash, debris, surplus materials and equipment from site.

3.14 INSPECTIONS, WARRANTY PERIOD AND FINAL ACCEPTANCE

A. At the completion of all irrigation work under this contract, and before the beginning of the one (1) year Maintenance and Warranty Period, an Irrigation Inspection shall be performed to establish the beginning of the ninety (90) day Establishment Period. Refer to Section 02935-Landscape Maintenance and Warranty.

B. Contractor shall request the Irrigation Inspection in writing to the Owner’s Agent ten (10) days prior to anticipated inspection date.

C. The Owner’s Agent, contractor and such others as the Owner’s Agent may designate shall be present at the Irrigation Inspection.

D. If, after the inspection, the Owner’s Agent is of the opinion that all work has been performed in accordance with the Contract documents and that the irrigation system is in satisfactory working condition, then the Owner’s Agent will issue the contractor written notice of acceptance of the irrigation portions of the Work and commencement of the Establishment Period.

E. Work requiring corrective action in the judgment of the Owner’s Agent shall be performed within ten days after the Irrigation Inspection. Corrective work and materials replacement shall be in accordance with the contract documents and shall be made by the contractor at no cost to the Owner.

F. Perform a water audit right after installation. See Section 02935-Landscape Maintenance and Warranty.

3.15 ACCEPTANCE INSPECTION FOR END OF ESTABLISHMENT PERIOD AND BEGINNING

OF WARRANTY AND MAINTENANCE PERIOD

A. At the completion of the ninety (90) day Establishment Period, the Final Acceptance Inspection shall be performed. If the Final Acceptance of the project is later than the end of the Warranty Period, then the Warranty Period shall be extended until Final Acceptance at no additional cost to the Owner.

B. The contractor shall request the inspection in writing to the Owner's Agent ten (10) working days before the completion of the Establishment Period or ten (10) working days prior to the date of the Final Inspection, whichever occurs later.

C. The Owner's Agent, Contractor, and such others as the Owner's Agent may designate, shall be present at the inspection.

D. If, after the inspection, the Owner's Agent is of the opinion that all work has been performed in accordance with the Contract Documents, and that the irrigation system is in operating order, then the Owner's Agent will issue written notice of Final Acceptance, the beginning of the Maintenance and Warranty Period.

E. Work requiring corrective action in the judgment of the Owner's Agent shall be performed within ten days after the Final Inspection. Corrective work and materials replacement shall be in accordance with the contract documents and shall be made by the contractor at no cost to the Owner.

F. Contractor shall submit as-built drawings, operation manual, water audit and irrigation records to the owner.

G. No partial approvals will be given.

END OF SECTION

SECTION 02920

STRUCTURAL SOIL
(CU SOIL)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes but is not necessarily limited to:
1. Furnishing and installation of structural soil.
2. Finish grading of landscape areas.

B. Related Sections:
1. Section 02518 - Concrete Pavers
2. Section 02950 – Tree Planting
3. Section 02810 – Irrigation System
4. Section 03300 – Cast-In-Place Concrete

C. References: All work shall conform to:
1. ENGEO, “Geotechnical Investigation, New Artist Building, Hunters Point Shipyard,” December 13, 2013.
2. Section 02200: Earthwork

1.2 SUBMITTALS

A. Procedures
All submittal data shall be forwarded in a single package to the Owner’s Agent.

B. Product Data: Submit (3) three manufacturer’s catalog cuts for all specified materials listed herein.
1. Base Rock
2. Clay or Clay-Loam Soil
3. Organic Amendment
4. Soil Conditioner
5. Additional Amendments as required
6. Soil Separator Fabric

C. Test Reports: submittals from materials test results are required at three stages in the process: before acceptance of the material, during the procedure of amending and mixing, and after the structural soil mix has been installed and compacted to engineering requirements
1. Prior to acceptance of materials:
a. Base Rock
(1) Analysis for salts and heavy metals
(2) Specific Gravity
(3) Bulk Density
(4) Percent Void Space
(5) Rock Hardness: Soundness ASTM No. C88 - 10% max;

Abrasion Loss ASTM No. C 535 – 30% max

b. Soil Analysis–Equal to Wallace Laboratories "Complete Standard Analysis"
c. Compost – Laboratory analysis as per specifications

2. During the amending and mixing process
   a. Complete Standard Analysis of five composite samples of the amended soil prior to the mixing with rock. Each composite made from 6-10 samples.
   b. Maximum Dry Bulk Density Test Reports of the amended soil (ASTM D-1557).
   c. Percent moisture content of amended soil.
3. After Installation
   a. Water Infiltration Test The water infiltration rate is to be a minimum of 3/4" per hour.
   b. Soil Bulk Density Test using a Neutron Probe. See Appendix E.

D. Testing Laboratory:
   1. Wallace Laboratories, 365 Coral Circle, El Segundo, CA 90245 (310) 615-0116

E. Testing Methods and Procedures: see Appendix E.

F. Purchase Documentation
   1. Soil Conditioner Purchase and Delivery Invoices
   2. Organic Amendment Purchase
   3. Base Rock Purchase and Delivery Invoices

1.3 SITE CONDITIONS

A. Environmental Requirements
   1. Do not work soil when moisture content is close to or at field capacity. Do not work soil when it is so dry that dust will form in the air or when clods will not break readily.
   2. Apply water, if necessary, to bring soil to an optimum moisture content for tilling. Optimum for a clay loam is about 20% by weight.
   3. Do not work soil when muddy or frozen.
   4. Do not apply chemicals if wind conditions will cause hazardous drift to people or property.

B. Existing Conditions
   1. 1. Prior to work commencement review and clearly mark in field horizontal and vertical locations of existing public underground utilities and structures with respective utility companies.

1.4 COORDINATION

A. Contractor shall be responsible for coordinating structural soil installation with work of other trades.

PART 2 - PRODUCTS

2.1 MATERIALS

A. CU SOIL – The CU SOIL is prepared under license from AMEREQ.INC. 19 Squadron Boulevard, New City, New York 10956 Phone (845) 834-2400. Local franchise is TMT ENETERPRISES, INC.1996 Oakland Road, San Jose, CA 95131 Telephone (408) 432-9429.

Specifications for the soil list the following:

1. Crushed Stone, D.O.T. (Department of Transportation) approved, angular 3/4" -1 1/2 100#
2. Clay Loam 5.5 to 6.5 pH, CEC>10, organic content 2% - 5%

Textural qualities of clay loam soil:

Fine sand	25%	- 30%
Silt	20%	- 40%
Clay	25%	- 40%

1. Fertility and pH is adjusted after laboratory analysis. No specifics are provided for fertility. Owners agent must provide this input. The soil specifications in this document may be applied to the acceptance or required amendments of the CU SOIL.
2. CU SOIL is compacted in 6" lifts. Compaction is to project engineer specifications.

B. Additional amendments, which may be required:

1. Fertilizer:
   a. Ammonium sulfate, Ammonium Nitrate (21-0-0)
   b. Ammonium nitrate (34-0-0)
   c. Sulfur Coated Urea (32-0-0) 22% sulfur
   d. Single Superphosphate (0-20-0)
   e. Triple super phosphate (0-45-0)
   f. Potassium sulfate (0-0-50)
   g. Calcium carbonate (CaCo3)
   h. Gypsum – Agricultural Gypsum (CaSO4- 2H20) 97%
   i. Humate ag, available: Humate International, 500 North Ellis Road, Jacksonville, Florida 32254, (904) 781-6512.

C. Soil Separator: Mirafi 140NC, as manufactured by Mirafi, Inc, Pendergrass, GA (706) 693-2226, or approved equal.

PART 3 – EXECUTION

3.1 SOIL AMENDING AND CONDITIONING

A. Soils are to be tested first, then amended as necessary at the rate specified by Wallace Laboratory. Incorporate dry amendments during initial screening - all amendments including compost and dry polymer (P.A.M.) are incorporated during screening.

Amendments are applied at the rate specified by Wallace Laboratory. Soil amendments are measured on a pounds per cubic yard of soil basis. Maximum particle size after first screening is 1/2".

1. Measurement – The volume of a front loader bucket is used as the primary unit for bulk soil measurement. Precise measurements of the volume of the bucket as well as the average bulk density of a level bucket are required. Fertilizer and amendments are measured in volumes appropriate for each unit (tractor bucket full).

B. Soil Preparation for Liquid Polymer Treatment
   1. After screening, spread the soil in a large flat area to a depth of 12".
      a. The site must have good drainage.
         The process of spreading the material shall be done in a manner that the front end loader does not drive over or compact any of the soil.
      b. Form a small berm at the top edge of the soil to retain the liquid polymer.

C. Mix the polymer with water per instructions.
   1. The water tank shall have a minimum 500 gallon capacity and a discharge pump.

D. Apply the solution to the surface of the soil.

E. Allow the solution to infiltrate until inspection reveals that the soil is evenly saturated with the P.A.M. solution.

F. Curing of amended soil: Allow the soil to cure and dry for a minimum of two days before disturbing.

G. Stockpiling Soil
   1. The soil is stockpiled until needed. Optimum moisture content for working the soil is 20%.Optimum moisture should be maintained by covering the stockpiled soil with a tarp to prevent drying, or the opposite, in the event of rain.

H. Screen the amended and conditioned soil to 1/2" maximum particle size just prior to mixing with the structural rock. Mixing should occur just prior to installation.

3.2 MEASUREMENT AND CALIBRATION OF EQUIPMENT

A. General – Material portions are by volume. Actual volume is determined through dry weight per unit volume at 100% maximum bulk density.

B. Rock – the bulk density and weight of all units of rock are required for calculation. The volume of rock required represents 100% of the volume of the excavation to be backfilled. Bulk density of the rock is taken to be 100% compaction.

C. Percent Void – the percent void space within the rock matrix is calculated in accordance with procedures contained herein**.** Crushed rock can vary in percent void space from about 35% to slightly above 50%. This is highly dependent upon the shape and size gradation of the rock. The estimated void of well graded crushed rock is about 45%.

D. Percent Soil – Soil is measured in volume calculated to fill 80% of the void space in the

rock. As the soil fits within the rock matrix the rock is taken to be 100% of the fill. The volume of the soil is based upon an average bulk density of 65% of maximum (ASTM D-1557). This volume of soil is adjusted to an average bulk density of 65%). Example: The percent void space in the rock is 45%, a given. The volume of soil is calculated as 80% of the 45% void space in the rock. Example: .45 x .8 = 36%. Thus 100 cubic yards of rock would be blended with 36 cubic yards of soil having dry bulk density of 65%.

E. Calibration of Loader Bucket – Calibration of the working volume of a level bucket should be as accurate as possible. The working volume of a bucket of soil is adjusted to an average bulk density of 65% of maximum. The bulk density is calibrated as dry bulk density.

F. Calibration of Soil Moisture Percentage - Optimum moisture percentage for working soil is considered to be 20%. Collect a soil sample having a representative moisture level. Weigh the soil sample. Completely dry the soil sample and weigh the soil again. Divide the difference in weight of the soil (water loss in drying) by the original weight of the soil. [Example: five pounds of soil weighing four pounds after drying. One pound, (the difference), divided by five, (original weight) is twenty percent moisture.]

3.3 PROCEDURES FOR MEASURING ROCK AND SOIL

A. General - All measurements for rock and soil are based upon cubic yards of material. Material is to be mixed with a front loader bucket and then with an excavator bucket in the planting trench.

B. Rock – Weight tags from the quarry supplying the rock will be used as the basic units of measurement. Rock volume is calculated from bulk density and the net weight of the rock.

1. Determining the volume of the rock

$$\frac{\text{Rock weight in tons}}{\text{Bulk Density (ton/cubic yard)}} = \text{cubic yards}$$

C. Soil - Unit volume measured in a level bucket of a front loading tractor. The working volume of a level loader bucket is to be calibrated to be at a bulk density of 65%. Depending upon the size of the bucket, partial bucket calibration measurements may be required.

D. Sequencing of Measurements - The soil volume is based upon the weight (volume) of rock. Rock is placed first and then the calculated volume of soil is placed on top of the rock.

3.4 PROCEDURE FOR MIXING ROCK AND SOIL

A. General – Creating a good root medium depends upon accurate measurement and sufficient mixing. Rock and soil should be mixed until they are homogenous, because any area of the mix having too high a proportion of soil will be subject to later settling.

B. The stone, clay loam soil and hydrogel (polyacrylamide) shall be mixed at a location where it can be stored up to 45 days. If rock and amended soil are mixed off site and stored prior to use, piles of material should be no larger than 40 cubic yards each. Piles

are to be covered by plastic tarp to prevent changes in moisture.

C. Prior to any mixing or installation of Structural Soil Mix, the Owner's Agent shall hold pre-installation meeting with the contractor to discuss schedules, methods and techniques for the mixing and delivery of the material.

D. All mixing shall be performed at the agreed upon site using appropriate soil mixing equipment of sufficient capacity and capability to assure proper quality control. No mixing of soils at the project site shall be permitted.

E. Perform mixing in clean area free of materials that may contaminate mix.

F. The contractor shall have available at the mixing site sufficient equipment and instrumentation, including qualified technicians, to determine weights and water content of the mix components immediately prior to the mixing procedure. The contractor shall monitor these critical elements throughout the mixing process to provide adequate quality control.
   1. The Contractor shall maintain a quality control log of material weight, water content and mix proportions for every 15 tons of material mixed.

G. The contractor shall mix sufficient material in advance of the time needed at the job site to allow adequate time for testing as required by the progress of the work. Structural Soil Mix shall be stored in piles of no more than 400 cubic yards and each pile shall be numbered for identification and testing purposes.

H. The contractor shall submit three-particle size distribution analyses from samples taken randomly through each 400 cubic yards of Structural soil Mix prepared. In the event that the particle size distribution varies significantly from the approved sample, as determined by the Owner's Agent, make adjustments to the mixing ratios or procedures and re-mix the lot. Re-test any lot of soil that fails to meet correct analysis after the adjustment has been made.

I. Correcting mistakes in blending – If the mix is found to be incorrect, or settlement has occurred after depositing in the planting trench, additional rock or soil can be added and blended. The blending of the structural soil mixing is complete when the Owner's Agent determines it to be so.

3.5 EXCAVATION, INSTALLATION AND COMPACTION

The following procedures apply to both the Gap Graded Soil and the CU Soil

A. Excavation of the tree trench
   1. Excavate tree planting trench as indicated on contract documents.
   2. Dispose of excavated spoils in accordance with paragraph 3.1 of Section 02200 "Earthwork".

B. Line Trench: Line two sides and ends of the tree trench with soil separator fabric. Lap joint 18" minimum. Install in accordance with manufacturer's instructions.

C. Compaction

1. Compact the mix in successive layers called lifts, each lift having maximum thickness of 12 inches. If compaction is not acceptable to Owner's Agent, lift thickness may be reduced. Specifications for CU SOIL require 6" lifts.
2. Compact the mix by using a roller. Corners and irregular areas which the roller cannot reach are to be compacted with a hand tamper. Vibrating compactors or jack hammer type compactors shall not be used.

D. Scarify Soil Surface: After each lift has been compacted, scarify the top 2" of soil prior to installing the next lift.

E Procedure at Tree Pits
1. Hold the tree planting pits open with tree containers to facilitate the installation of the tree root balls and reduce settling around the tree.
2. Base soil of the structural soil mix shall be used for planting backfill.

3.6 FIELD QUALITY CONTROL

A. Testing Agency Services: The Owner's Agent will observe placement of structural soil. Contractor shall not proceed until previously completed work has been verified for compliance with requirements.

B. Whenever acceptance of the Owner's is required by these Specifications, the Contractor shall notify the Owner's Agent at least 48 hours prior to commencing any phase of earthwork.
1. No phase of the work shall proceed until the prior phase of work has been accepted by the Owner's Agent.
2. Work shall not be covered up or continued until acceptance of the Owner's Agent has been obtained.
3. The Owner's Agent will give written notice of conformance with the Specifications upon completion of grading.

C. The Owner's Agent has been retained to observe performance of work under this section.
1. If in the opinion of the Owner's Agent, the work performed does not meet the technical or design requirements stipulated, the Contractor shall make the necessary readjustments as required by the Owner's Agent.
2. No deviations from the contract documents shall be made without specific and written acceptance of the Owner's Agent.
3. In the event of conflict between the Specifications and the recommendations contained in the Geotechnical Report, the Owner's Agent shall be notified.
    a. The Contractor shall follow clarification and interpretation memoranda prepared by the Owner's Agent at no additional cost to the Owner.
    b. If clarification or interpretation memoranda should result in a change in the scope of work, as adjustment in the contract price will be mutually agreed upon by the Contractor and the Owner.

D. The Owner's Agent's review of the Contractor's performance does not include review of the Contractor's safety measures.

E. Settlement Mock-Up: Contractor shall provide Mock up of Structural Soil mix at the specified depths and apply irrigation to induce settlement. No settlement will occur when

the proportions and density of rock and soil are correct and well homogenized.

F. Planting Site Settling Prevention – Settling of the paving stone around and be avoided by the following:

1. Use Smaller Size Trees – Planting 15 gallon size or no larger that 24" box size will reduce to size of the hole required in the structural soil.
2. Use Rootball Place Holder – Use of a 15 gallon or 24" tree box to hold the planting site open for the tree will reduce the size of the opening in the structural soil. The container is placed in the proposed tree planting location when the structural soil level reaches the level of the bottom of the rootball. The container is filled with structural soil, sand or other material to provide weight and protect it from being distorted by the structural soil when compacted. The area immediately around the container is hand compacted in the same manner as the corners of the structural soil. The container is rigged with rope or cable to allow for easy removal prior to the planting of the tree. After the tree rootball is in place a minimal amount of soil is used to fill the space around the tree rootball. Tree rootcrown elevation can be adjusted upward in the same manner.

END OF SECTION

SECTION 02921

SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes but is not necessarily limited to:
1. Furnishing and installation of soil and soil amendments products, including all imported topsoil as required to make up deficiencies in quantity of soil available on site.
2. Furnishing and installation of Bio-Filtration Soil Filter Mix within precast flow through planter boxes.
3. Finish grading of landscape areas.
4. Mandatory Testing Requirements.

B. Related Sections:
1. Section 02200 – Earthwork
2. Section 02935 – Landscape Maintenance and Warranty
3. Section 02810 – Irrigation System
4. Section 02950 – Tree Planting
5. Section 02952 – Shrub Planting
6. Section 02953 – Lawns

C. References: All work shall conform to:
1. ENGEO, "Geotechnical Investigation, New Artist Building, Hunters Point Shipyard," December 13, 2013.
2. Section 02200: Earthwork
3. SFPUC Pre-construction Kick-off meeting for Green Stormwater Infrastructure installation. Contact SFPUC staff Mike Adamow, madamow@sfwater.org

1.2 SUBMITTALS

A. Procedures
All submittal data shall be forwarded in a single package to the Owner's Agent.

B. Product Data: Submit (3) three manufacturer's catalog cuts for all specified materials listed herein.
1. Imported Top Soil for planting areas, planters and lawn
2. Organic Amendment
3. Soil Conditioner
4. Additional Amendments as required
5. Soil Separator Fabric
6. Soil Filter Mix for Bio Retention Areas
7. Drain Rock

C. Test Reports: submittals from materials test results are required at three stages in the

process:

1. Prior to acceptance of materials:
   a. Soil – Complete Standard Analysis and bulk density.
   b. Compost – Laboratory analysis as per specifications

2. After amending and mixing
   a. Complete Standard Analysis of five composite samples of the amended soil.
   b. Maximum Dry Bulk Density Test Reports of the amended soil (ASTM D-1557).
   c. Percent moisture content of amended soil.

3. After installation and before planting and mulching
   a. Water Infiltration Test The water infiltration rate is to be a minimum of 5" per hour.
   b. Infiltration test method to be the double ring infiltrometer.

D. Testing Laboratory:
   1. Wallace Laboratories, 365 Coral Circle, El Segundo, CA 90245 (310) 615-0116

E. Purchase Documentation
   1. Soil Conditioner Purchase and Delivery Invoices
   2. Organic Amendment Purchase and Delivery Invoices
   3. Soil Purchase Invoices

F. Soil Filter Mix Submittals
   1. Product Data and Samples: Furnish copies of manufacturer's literature and laboratory analytical data for review of the followings items:
   2. Soil Filter Mix for bio-filtration beds, 1 quart
      a. Provide certifications from the Soil Filter Mix supplier or an accredited laboratory that the Soil Filter Mix meets the requirements of this guidelines specification including:
         i. Results from test ASTM F1815-06 (method A) [saturated hydraulic conductivity], ASTM D422 [grain size analysis]. Approved testing labs include:
            1. Cooper Testing Labs, 650-213-8436
         ii. Results from A17 Test [detailed fertility package]. Approved testing labs include:
            1. Plant and Soil Laboratory, 408-727-0330
         iii. Description of equipment and methods used to mix the sand and compost to produce Soil Filter Mix.

   3. Test Reports: Submit the results of the following tests to the Engineer:
      a. Soil Filter Mix for bio-filtration beds: Test A17 for soil fertility and micronutrient analysis.

   4. Tests (ASTM F1815-06, ASTM D422 and A17) shall be conducted prior to the first load delivered to the site.

PART 2 - PRODUCTS

2.1 IMPORTED TOPSOIL

A. Quantity: Quantity of topsoil to complete the work shall be calculated by the Contractor.

B. Stockpiling: Stockpile on site as directed by Contractor.

C. Composition: Fertile, friable, well-drained soil, of uniform quality, free of stones over 1 in. diameter, sticks, oils, chemicals, plaster, concrete and other deleterious materials. General: Topsoil shall be free of roots, clods, stones larger than 1-inch in the greatest dimension, pockets of course sand, noxious weeds, sticks, lumber, brush and other litter.

D. Soil Sampling Method: A minimum of three samples shall be taken for analysis from any potential source of homogenous soil prior to acceptance. Each sample is to be approximately one quart in volume and a composite from 6-10 locations.

E. Test Results: Request Testing Agency to send one (1) copy of test results direct to the Owner's Agent and one (1) copy to the Owner. Imported topsoil shall be amended per soils analysis report.

F. The Owner's Agent reserves the right to take samples of the imported topsoil delivered to the site for conformance to the Specifications.

G. Rejected Topsoil: Immediately remove rejected topsoil off the site at Contractor's expense.

H. Gradation Limits: the soil shall be a sandy loam. The definition of soil texture shall be the USDA classification scheme.

I. Fertility: The range of essential elements concentration in soil shall be as follows:

Ammonium Bicarbonate/DTPA Extract
Parts per million (mg/kilogram)
Dry weight basis
phosphorus 2-40
potassium 40-220
iron 2-35
manganese 0.3-6
zinc 0.6-8
copper 0.1-5
boron 0.2-1
magnesium 50-150 sodium 0-100
sulfur 25-500
molybdenum 0.1-30

J. Acidity: The soil pH range measured in the saturation extract (Method 21a, USDA Handbook number 60) shall be 6.5 – 7.2

K. Salinity: The salinity range measured in the saturation extract, the maximum salinity shall be 4.0 dS/m.

L. Chloride: The maximum concentration of soluble chloride in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 150 mg/1 ppm.

M. Boron: The maximum concentration of soluble boron in the saturation extract (Method 3a, USDA Handbook Number 60) shall be 1 mg/1 ppm

N. Sodium Absorption Ratio (SAR): The maximum SAR shall be 4 (measured per Method 20b, USDA Handbook Number 60).

O. Soil Organic Matter Content: soil organic matter shall be 6-10% by dry weight.

P. Calcium Carbonate Content: Free calcium carbonate shall not be present.

Q. Heavy Metals – the maximum permissible elemental concentration in the soil shall not exceed the following:

Ammonium Bicarbonate/DTPA Extract
in parts per million (mg/kilogram) on a dry weight basis:
Arsenic 2
Cadmium 2
Chromium 10
Cobalt 2
Lead 30
Mercury 1
Nickel 5
Selenium 3
Silver 0.5
Vanadium 3

If the pH is between 6 and 7, the maximum permissible elemental concentration shall be reduced 50%. If the soil pH is less than 6.0, the maximum permissible elemental concentration shall be reduced 75%. No more than three metals shall be present at 50% or more of the above values.

R. Phytotoxic constituent, herbicide, hydrocarbons etc. Germination and growth of plants shall not be restricted more than 10% compared to standard controls. Standards controls shall be both monocots and dicots. Total petroleum hydrocarbons shall not exceed 100mg/kg dry soil measured per EPA Method No. 8002.

2.2 ACCESSORIES

A. Fine Sand: Santa Cruz Sand or Equal.

1. Physical Properties (by dry weight basis):

Percent Passing Sieve Size	
100	4.76 mm(#4, 4 mesh)
95-100	1.00 mm (#18, 16 mesh)
65-100	500 micron (#35, 32 mesh)
0- 50	250 micron (#60, 60 mesh)
0- 20	105 micron (#140, 150 mesh)
0- 5	53 micron (#270, 270 mesh)

2. Chemical Properties: (by Saturation Extract Method):
   a. Soluble Salts/Salinity: Maximum conductivity of 3.0 millimhos/cm at 25 degrees C.
   b. Boron: Maximum concentration of 1.0 ppm.
   c. Sodium Absorption Ratio (SAR): Maximum 6.0.
3. Same upper limit for contaminants as listed for sandy loam.

B. Water: Clean, fresh and potable, as available from Owner. Transport as required.

2.3 ORGANIC COMPONENTS

A. Organic Amendment: Organic material is to be a well composted humus with the following properties:
1. Humus material shall have an ash content of no less than 8% and no more than 50%.
2. The pH of the material shall be between 6 and 7.5.
3. The salt content shall be less than 10 millimho/cm @ 25 degrees C. (Ece less than 10) on a saturated paste extract. If the Ece exceeds 10 millimho/cm, the maximum rate of sue shall not exceed 15 % by volume. If the concentration of calcium sulfate in the saturation extract is greater than 25 milliequivalents per liter, the maximum level of salinity can be increased 3 millimho/cm @ 25 degrees C. units (13 millimho/cm @ 25 degrees C).
4. Boron content of the saturated extract shall be less than 1.0 parts per million.
5. Silicon content (acid-insoluable ash) shall be less than 20%.
6. Calcium carbonate shall not be present if the amendment is applied on alkaline soils.
7. Types of acceptable products are composts, manures, mushroom composts, straw, alfalfa, sludge, peat mosses etc. low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.
8. Composted wood products are conditionally acceptable (stable humus must be present). Wood based products are not acceptable which are based on redwood or cedar.
9. Sludge-based materials are not acceptable if the soil already has a high level (toxic level) of zinc, copper or other heavy metals based on soil analysis.
10. Carbon:nitrogen ratio is less than 25:1
11. The compost shall be aerobic without malodorous presence of decomposition products.
12. The maximum particle size shall be 0.5 inch, 80% more shall pass a No. 4 screen.
13. Maximum total permissible pollutant concentrations in organic amendment in parts per million on a dry weight basis:

arsenic	20	Molybdenum	60
Cadmium	15	nickel	100
Chromium	100	Selenium	30
Cobalt	50	Silver	10
Copper	150	Vanadium	50
Lead	100	zinc	200
Mercury	10		

14. Higher amounts of salinity of boron may be present if the soils are to be pre-

leached to reduce the excess or if the plant species will tolerate the salinity and/or boron.

B. Nitrogen-Treated Sawdust:
1. Type: Derived from redwood, fir or cedar wood sawdust.
2. Physical Properties: Percent Passing Sieve Size
95-100 6.35 mm. (1/4 in.)
80-100 2.38 mm. (#8, 8 mesh)
0- 30 500 micron (#35, 32 mesh)
3. Chemical Properties:
Nitrogen content (dry weight basis):
Wood of Redwood 0.4 - 0.6%
Wood of Fir/Cedar 0.56 - 0.84%
Iron content (dry weight basis): 0.08% iron as metallic, minimum.
Salinity/Soluble salts: Maximum 3.5 millimhos/cm 25 degrees C. as determined by saturation extract method.
Ash (dry weight basis): 0 - 6.0 percent maximum.

C. Treated Fir/Pine Bark:
1. Physical Properties (dry weight basis):
Percent Passing Sieve Size
95-100 6.35 mm (1/4 in.)
80-100 2.38 mm (#8, 8 mesh)
0- 30 500 micron (#35, 32 mesh)
2. Organic Content (dry weight basis): 94 percent minimum as determined by ash analysis.
3. Chemical Properties:
Nitrogen Content (dry weight basis): 0.8 percent minimum.

Soluble Salts/Salinity: Maximum Saturation Extract Conductivity 3.0 millimhos/cm at 25 degrees C, by method.
Iron (dry weight basis): 0.08 percent minimum.
pH: 6.5 - 7.5
4. Wettability:
a. When applied to a cup or small beaker of water @ 70 degrees F. in the amount of 1 teaspoon, the air-dry product shall become completely wet in a period not exceeding 2 minutes.
b. All wetting agents to be non-phytotoxic at rate used.

2.4 COMMERCIAL FERTILIZERS

A. Pre-Plant Fertilizer: Mixed by a commercial fertilizer supplier and consisting of low nitrogen <6% fertilizer.

2.5 CHEMICAL COMPONENTS:

The following additives may or may not be used depending on the outcome of the soils report.

A. Ground Limestone: Agricultural limestone containing not less than 85% of total

carbonates, ground to such fineness that 50% will pass #100 sieve and 90% will pass #20 sieve.

B. Dolomite Lime: Agricultural grade mineral soil conditioner containing 35% minimum magnesium carbonate and 49% minimum calcium carbonate, 100% passing #65 sieve. "Kaiser Dolomite 65 AG" by Kaiser, Inc. Mineral Products Department, or accepted equal.

C. Gypsum: Agricultural grade product containing 80% minimum calcium sulphate.

D. Iron Sulfate (Ferric or Ferrous): Supplied by a commercial fertilizer supplier, containing 20% to 30% iron and 35% to 40% sulphur.

E. Sulphate of Potash: Agricultural grade containing 50% to 53% of water-soluble potash.

F. Single Superphosphate: Commercial product containing 20% to 25% available phosphoric acid.

G. Ammonium Sulphate: Commercial product containing approximately 21% ammonia.

H. Ammonium Nitrate: Commercial product containing approximately 34% ammonia.

I. Calcium Nitrate: Agricultural grade containing 15-1/2% nitrogen.

J. Urea Formaldehyde: Granular commercial product containing 38% nitrogen.

K. I.B.D.U. (Iso Butyldiene Diurea): Commercial product containing 31% nitrogen.

L. Soil Sulfur: Agricultural grade sulfur containing a minimum of 96% sulfur.

M. Iron Sequestrene: Geigy Iron Sequestrene 330 Fe, by Ciba-Geigy Corporation, (919) 292-7100.

2.6 LAWN ROOT ZONE MIX (SAND BASE)

A. Gravel Base: Not more than 10% of the particles greater than 1/2". At least 65% of the particles between 1/4" and 3/8". Not more than 10% of the particles less than 2mm.

B. Intermediate Layer Material: At least 90% of the particles between 1mm and 4mm.

C. Sand Selection:

Name	Particle Diameter	Recommendation by Weight
Fine Gravel	2.0-3.4mm	Not more than 10% of the total particles in this range, including a maximum of 3% fine gravel, preferably none.
Very Coarse Sand	1.0-2.0mm	Same

Name

Coarse Sand	0.5-1.0mm	Minimum of 60% of the particles must fall in this range.
Medium Sand	0.25-0.50mm	Not more than 20% of the particles may fall within this range
Fine Sand	0.15-0.25mm	Not more than 20% of the total particles in this range
Very Fine Sand	0.05-0.15mm	Not more than 5% of the total particles in this range shall exceed 10%.
Silt	0.002-0.05mm	
Clay	Less than 0.002mm	

2.7 BIO-FILTRATION

A. Soil Filter Mix: To be supplied by L.H. Voss Landscape Materials, Fremont and Dublin, CA. contact information Rob Hawkins (925) 676-7910 ext. 108 or approved equal.

B. Soil Filter Mix shall consist of 50-60% coarse sand, 10-20% fine sand, 15-20% organics by volume.

C. Soil Filter Mix shall contain less than 5% fines (silt and clay) content.

D. Infiltration rate shall be a minimum of 5 inches per hour.

E. Soil Filter Mix shall be supplied from one single approved production batch meeting specifications and testing requirements identified in Section 1.3, or if additional batches are required, provide new testing results as identified in Section 1.3 that demonstrate the Soil Filter Mix meets specifications.

F. Initially delivered batch from approved Soil Filter Mix shall be tested using ASTM F1815-06 (method A) [saturated hydraulic conductivity] to confirm that the percolation rate meets specifications prior to installation. Approved testing labs include: Cooper Testing Labs, 650-213-8436.

G. Each delivered batch of Soil Filter Mix for bio-filtration beds should be accompanied by a certification letter from the supplier verifying that the material meets specifications and is supplied from the approved Soil Filter Mix stockpile. Soil Filter Mix shall not be mixed and/or stockpiled onsite.

H. Rock Mulch for Bioretention planters and Bioswales Type; Hard, durable smooth river washed stone, ¾ inch to 1 inch diameter in brown color range, Lin Creek or equal.

2.8 DRAIN ROCK

A. Drain Rock (Permeable Backfill): Permeable backfill used in subsurface drain installations to be open graded clean gravel consisting of 3"- 4" No. 9 choking course over No 7 (Caltrans Class 1Type A or equivalent). Submit sample for approval

1. Table 1

a. Base Grading Requirements ASTM stone size No. 7

Sieve Size	Percent Passing
3/4 in.	100%
1/2 in.	90 to 100%
3/8 in.	40 to 70%
No. 4	0 to 15%
No. 8	0 to 5%

2. Table 2

a. Base Grading Requirements ASTM stone size No. 9

Sieve Size	Percent Passing
3/8 in.	100%
No. 4.	85 to 100%
No. 8	10 to 40%
No. 16	0 to 10%
No. 50	0 to 5%

PART 3 - EXECUTION

3.1 SOIL MOISTURE CONTENT

A. General: Do not work soil when moisture content is so great that excessive compaction will occur, nor when it is so dry that dust will form in air or that clods will not break readily. Apply water, if necessary, to bring soil to an optimum moisture content for tilling and planting.

B. Range: Maintain within 2 percent above or below optimum moisture content at all times during the work.

3.2 SPREADING OF TOPSOIL

A. General: Spread Stockpiled topsoil over accepted subgrade prior to incorporating amendments.

B. Restrictions: Do not commence spreading of topsoil prior to acceptance of soil cultivation above. Do not place topsoil under muddy conditions.

C. Topsoil Depth: Minimum depth of (6 in.) (12 in.) after natural settlement and light rolling conforming to finished grades shown on Drawings.

3.3 PLACEMENT OF SOIL FILTER MIX

A. Soil must not be placed until after placement of final street paving wear course.

B. Restrictions: Do not commence spreading of soil filter mix prior to acceptance of open graded gravel .

C. General: Spread mix over accepted 12 inch open graded gravel.

D. Spread soil using 3-6” lifts, boot compact between lifts.

E. No mechanical compaction is allowed.

F. Soil Filter Mix Depth: 18 inches after natural settlement and conforming to finished grades shown on Drawings.

G. Place sand bags at Flow Through Planter curb inlets to block water from entering or exiting the planters and causing soil displacement and plant damage during establishment. Maintain blockage until plant roots can become established and roots to hold the soil.

H. Placement of filter soil media shall occur after the installation of the final wear course on the adjacent street. In the interim, contractor shall follow procedures prescribed in the Erosion Control Plans.

3.4 SOIL AMENDMENT

A. Amending of Spread Topsoil:
   1. Soil Amendments per 1,000 square feet: Incorporate thoroughly with top six (6) in. as dictated per soil test. Do not use more than 3 lbs of Nitrogen per 1000 square feet.

3.5 FIELD QUALITY CONTROL

A. Tests: Owner’s Agent reserves the right to take samples of soil mixes and amended soil for testing for conformity to Specifications.

B. Rejected Materials: Remove off site at Contractor's cost.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

A. Standard Specifications of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SSDPWSF), Latest Edition. Also referred to as "City Standard Specifications."

B. Standard Plans of the City and County of San Francisco, Department of Public Works, Bureau of Engineering (SPDPWSF), Latest Edition. Also referred to as "City Standard Plans."

C. Department of Public Works (DPW) Order No. 176,707 "Regulations for Excavating and Restoring Streets in San Francisco", approved March 26, 2007.

D. ENGEO, "Geotechnical Investigation, New Artist Building, Hunters Point Shipyard," December 13, 2013.

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.

B. Included Work:
1. All Concrete shall conform to this specification except where concrete items are specified by City Standard Specifications**,** Section 800, unless otherwise indicated below.
2. Concrete for Pole Foundations
3. Concrete Curbs shall conform to Section 202 of the City Standard Specification, except as modified by these Construction Documents.
4. Combined Concrete Curb and Gutter shall conform to Section 203 of the City Standard Specification, except as modified by these Construction Documents.
5. Concrete Sidewalk shall conform to Section 204 of the City Standard Specification, except as modified by these Construction Documents.
6. Concrete Driveways shall conform to Section 210 of the City Standard Specification, except as modified by these Construction Documents.
7. Concrete Structures shall conform to Section 411 of the City Standard Specification, except as modified by these Construction Documents.

C. Related Sections include the following:
1. Section 02200, "Earthwork".
2. Section 02225, "Excavation, Backfilling, and Compacting for Utilities".

3. Section 03350, “Special Concrete Colors and Finishes”.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
1. Indicate amounts of mix water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement. Include special reinforcement required for openings through concrete structures.

D. Formwork Shop Drawings shall be prepared by or under the supervision of a qualified Professional Engineer and shall detail fabrication, assembly, and support of formwork.

E. Shoring and Re-shoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing re-shoring.

F. Welding Certificates: Copies of certificates for welding procedures and personnel.

G. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials.

H. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
1. Cementitious materials and aggregates.
2. Form materials and form-release agents.
3. Steel reinforcement and reinforcement accessories.
4. Admixtures.
5. Curing materials.
6. Bonding agents.
7. Adhesives.
8. Vapor retarders.
9. Epoxy joint filler.
10. Joint-filler strips.

I. Mock-ups

1. Submit two full-scale mock-up (minimum 4’ by 4’) sample panels of all concrete finishes and colors. . The samples shall include curing compound if any is to be used, and include an expansion joint and a score joint, as indicated on the Drawings. Approved samples shall be kept at the job site to serve as a prerequisite for all finishes until acceptance of the Work.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. The Contractor shall be responsible for quality of concrete in place and shall bear burden of proof that concrete meets minimum requirements. Contractor shall confirm that site soils do not contain elevated levels of sulfate that would require sulfate resistant concrete as outlined in Table 4.3.1 of the ACI 318 Building Code or Table 19B-A-3 of the Uniform Building Code. If the site soils contain elevated levels of sulfate, it is the Contractor’s responsibility to request mixes that meet the aforementioned requirements.

C. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
   1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities. Submit Certifications to Owner’s Agent

D. Testing Agency Qualifications: An independent testing agency, acceptable to the Owner, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

E. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

F. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

G. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
   1. ACI 301, "Specification for Structural Concrete."
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

H. Formwork Design Criteria: Formwork shall conform to ACI 318, Section 6.1 and CBC Section 1906A.
   1. Formwork:
      a. Shall prevent leakage or washing out of cement mortar.

b. Shall resist spread, shifting, and settling.
c. Shall reproduce accurately required lines, grades and surfaces within tolerances specified.

2. Safety: The Contractor shall be responsible for adequate strength and safety of all formwork including falsework and shoring.
3. Formwork allowable tolerances: Formwork shall produce concrete within tolerance limits recommended in ACI 318, Section 6.1, unless otherwise noted.

I. Stipulations
1. Finish Surface Tolerance: 1/4-inch maximum variation in 10 feet.
2. At no point shall paving surface fail to drain.
3. Finish Concrete Surface Slip Resistance: Shall have a minimum slip resistance coefficient of 0.65 on concrete pavement with less than 5% slope and 0.8 on concrete pavement with more than 5% slope.
4. Walls retaining soil that retain 30 inches or more of soil shall include a subsurface drain behind wall per Section 68 of the Standard Specifications and as accepted by the Owner's Agent. Drain line shall be connected to storm drain system as accepted by Owner's Agent.
5. Walls retaining soil that retain 18 inches or more of soil shall receive Dampproofing per Caltrans Standard Specifications, Section 54.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Supply ready mixed concrete throughout. Batch, mix and transport in accordance with ASTM C-94, "Specifications for Ready Mixed Concrete."

B. Mix and deliver concrete in quantities that will permit immediate use only.

C. Indiscriminate addition of water for any reason will be cause for rejection of the load.

D. Deliver, store, and handle steel reinforcement to prevent bending and damage.
1. Avoid damaging coatings on steel reinforcement.
2. Repair damaged epoxy coatings on steel reinforcement according to ASTM D 3963.

1.7 COORDINATION

A. Coordinate items of other trades. Contractor shall be responsible for the proper installation of all accessories embedded in the concrete and for the provision of holes, openings, etc., necessary to the execution of the work of the trades.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize

number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
   a. High-density overlay, Class 1, or better.
   b. Medium-density overlay, Class 1, or better, mill-release agent treated and edge sealed.
   c. Structural 1, B-B, or better, mill oiled and edge sealed.
   d. B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of the exposed concrete surface.
2. Furnish ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60 (Grade 420), deformed.

B. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

C. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.

D. All reinforcing steel, bolts anchors, sleeves, etc. shall be securely anchored in place before concrete is placed. All reinforcing details, fabrication and installation shall conform to ACI Standard 315, latest edition, except as noted. Stagger all splices where practical and not otherwise detailed. Minimum concrete protection for reinforcement shall be as follows unless otherwise noted:

1. 3" clearance where concrete is placed against the earth.
2. 2" clearance where concrete is exposed to earth but placed in forms.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to (CRSI) "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

B. Joint Dowel Bars: Plain-steel bars, ASTM A 615, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.

C. Epoxy-Coated Joint Dowel Bars: ASTM A 775; with ASTM A 615, Grade 60 (Grade 420), plain-steel bars.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type II Modified

B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:

1. Class: Moderate weathering region, but not less than 3M.
2. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 (0.3-mm) sieve, and less than 8 percent may be retained on sieves finer than No. 50 (0.3 mm).
3. Aggregate: In accordance with the requirements of Sections 800.03, 800.04, 800.05, and 800.06 of SSDPWSF, the Contractor shall substitute recycled concrete for a portion of the virgin aggregate in an amount no less than 15% of the total dry aggregate mass. The recycled concrete material shall meet or exceed the specified requirements. When recycled material is used for concrete base, exposed concrete applications, such as, sidewalk, curb, gutter, parking strip, pavement, and curb ramp, the Sodium Sulfate Soundness test (ASTM C88) is waived. Recycled concrete material will not be allowed in structural concrete or decorative concrete with an exposed aggregate finish."

C. Water: Potable and complying with ASTM C 94.

D. Fly ash:ASTM C618 for Class F fly ash.

2.5 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Solvent-Borne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.7 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

B. Reglets: Fabricate reglets of not less than 0.0217-inch thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

C. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336-inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

D. Concrete Test Cylinders: The Contractor shall supply four (4) standard concrete test cylinders per 100 cubic yards or fraction thereof for every concrete pour.

E. Aggregate Base: Crushed aggregate, R-78 minimum, 3/4-inch maximum, conforming to Standard Specification 26.1.02A, Class 2.

F. Expansion Joint Material
   1. Fiber Expansion Joint: A non-extruding resilient filler, saturated with high quality bituminous materials having preserving characteristics. Conform to ASTM-D1751-04.

G. Dampproofing: Per CALTRANS Standard Specifications, Section 54.

H. Grout: Premixed high strength non-shrink grout requiring only addition of water at the site. Burke's "Non-Ferrous, Non-Shrink Grout"; Master Builders "Masterflow 928 Grout", or equal.

I. Patching Mortar: Mix in proportions by volume of one part cement to two parts fine sand. Provide integrally colored patching mortar as required to match color and finish of colored concrete surfaces.

2.8 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

C. Proportion normal-weight concrete mix as follows:
1. Compressive Strength (28 Days, psi):
   a. Road Base – Class 5.5–3000–1 1/2"
   b. Curb/Gutter – Class 6-3000-3/4"
   c. Sidewalk – Class 5.5-3000-3/4"
   d. Concrete Structures:
      - Conform to to Caltrans Standard Specifications Section 90
      - Minimum Amount of Cementations Material: 675 lbs /CY of concrete
      - Minimum Fly-ash Content: 15%
      - Maximum Aggregate Size: 3/4"
      - Minimum Compressive Strength: 4500 psi
      - Maximum Water Cement Ratio: 0.45
   e. Cast-in-Drilled-Hole Concrete Piles:
      - Conform to Caltrans Standard Specifications Section 90
      - Minimum Amount of Cementations Material: 675 lbs /CY of concrete
      - Minimum Fly-ash Content: 15%
      - Maximum Aggregate Size: 1/2" or 3/8"
      - Minimum Compressive Strength: 4500 psi
      - Slump: Equal to or greater than 7"
   f. Other – Class 6-3000-3/4"
2. Maximum Slump: 4 inches, except Class 5.5-3000-1 1/2" which shall be 3 inches.

D. Cementitious Materials, Exposed to Deicers: For concrete exposed to deicers, limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 requirements.

E. Cementitious Materials, General: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.

3. Ground Granulated Blast-Furnace Slag: 50 percent.
4. Combined Fly Ash or Pozzolan and Ground Granulated Blast-Furnace Slag: 50 percent Portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
5. Silica Fume: 10 percent.
6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
7. Combined Fly Ash or Pozzolans, Ground Granulated Blast-Furnace Slag, and Silica Fume: 50 percent Portland cement minimum, with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

F. Maximum Water-Cementitious Materials Ratio, Severe Sulfate Exposure: 0.45 for concrete subject to severe sulfate exposure.

G. Air Content, General: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content stated below.

H. Air Content, 1-inch Aggregate: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:
1. Air Content: 6 percent for 1-inch- (25-mm-) nominal maximum aggregate size.

I. Do not air entrain concrete to trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent for those applications.

J. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

K. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixes where indicated.

L. Concrete Test Cylinder: The Contractor shall provide one set of four (4) concrete test cylinders per 100 cubic yards of concrete or portions thereof for every concrete pour.

M. Lampblack: As supplied by batch plant for plain non-colored concrete work. Concrete for non-colored pavements shall be darkened by the addition of lampblack at the mixer. The proportion of lampblack or other approved colorant shall be that required to properly darken the concrete to reduce glare, and shall be subject to the approval of the Owner's Agent. Provide ¾ pound of lampblack per cubic yard of concrete unless required otherwise.

2.9 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI "Manual of Standard Practice."

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116. Furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
   1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
   2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing times by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
   3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

2.11 EPOXY

A. Where metal items, such as architectural vault covers (AVC’s), are placed on precast or cast-in-place concrete, provide epoxy bond.
   1. Two-component, “CIA-GEL 7000” by Covert Operation, Long Beach, CA or accepted equal.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install all concrete work true to line and grade as indicated on the drawings.

B. Correct irregularities to the satisfaction of the Owner's Agent.

C. Plain non-colored, exposed concrete shall contain lampblack, approximately 3/4 pound of lampblack per cubic yard, as accepted by Owner’s Agent.

D. The intent of the Grading Drawings is to provide positive drainage and to maintain slopes on walkways as required by the Americans with Disabilities act and California Title 24 throughout the project site. Notify the Owner's Agent immediately of any discrepancies between the Drawings and actual field conditions and/or conflicts between the design and Code requirements.

3.2 PREPARATION

A. Examine subgrades and installation conditions. Do not start concrete work until unsatisfactory conditions are corrected.

B. Provide subgrade preparation and the base material installation complete, including clearing, grading, excavation, filling and dewatering. Take every precaution to obtain a subgrade of uniform bearing power compacted to a minimum of 95% relative compaction as determined by the ASTM D1557 laboratory test procedure and in Sections 19 and 20 of the Caltrans Standard Specifications.

C. Subgrade shall be kept moist and shall not be allowed to dry out before placement of concrete. Place no material on muddy subgrade. Remove un-compactable material and replace with clean fill and compact as required.

D. Aggregate base, where indicated, shall be placed and compacted in conformance with Caltrans Standard Specifications 26-1.04 and 26-1.05.

E. Obtain approval of subgrade from Owner's Agent prior to placing steel and concrete.

3.3 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117. Curbs, gutters and sidewalks shall be set within 0.03’ of designated grades.

C. Construct forms tight enough to prevent loss of concrete mortar.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.
   1. Do not use rust-stained steel form-facing material.

E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

G. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

H. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

I. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

J. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement or pouring concrete.

K. Forms for exposed surfaces shall be constructed to protect intended finish. Deflection of facing material between studs shall not exceed 0.0025 of the span. Facing material and pattern of joints shall be as approved by the Owner's Agent.

L. For vertical surface of wall footings below grade, clean cut trench may be used in lieu of form if character of soil will permit installation without sluffing and width of concrete is increased at least 1 inch beyond indicated dimension of each face poured against earth.

M. Curb and pavement edge forms shall extend full depth of concrete and shall be coordinated with installation of planting root barriers where required. Curves shall be formed with flexible metal or wood made up of thin laminations. Curve forms shall extend one stake space straight beyond tangent point. Where curbs and pavement are adjacent to areas to receive root barriers, provide smooth uniform edges. Remove any excess concrete as required to allow installation of root barriers without gaps between curbs and/or pavement and barriers.

N. Maintain forms within the following tolerances.
   1. Top of Form: Plus or minus 1/8 inch in 10 feet and no abrupt variations; at required elevation to plus 3/8 inch.
   2. Face of Form: Plus or minus 1/4 inch in 10 feet longitudinal and no abrupt variations; perpendicular to surface plus or minus 1/8 inch.

O. After concrete is placed, the following minimum times shall elapse before removal of forms.
   1. Walls: 48 hours.
   2. Footing sides: 24 hours.

3.4 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor bolts, accurately located, to elevations required.
   2. Install reglets to receive top edge of foundation sheet waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.

3.5 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained.

B. Leave formwork for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved at least 70 percent of 28-day design compressive strength. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

C. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

D. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Owner's Agent.

3.6 STEEL REINFORCEMENT

A. General: Comply with CRSI "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing.

   Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete. Where new pavements join existing, joints shall align.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Owner's Agent.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.

C. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
   1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

D. Tooled Joints / Score Joints
   1. Form joints in fresh concrete using a jointer to cut the groove so that a smooth, uniform impression is obtained to 1/4 depth of pavement unless shown otherwise.
   2. All joints shall be struck before and after brooming. Tool concrete both sides of joint.
   3. If joint pattern is not shown, provide joints not exceeding 6 feet in either direction and located to conform to column centerlines, wall corners, etc. as accepted by Owner’s Agent.

3.8 CONCRETE PLACEMENT

A. Mixed concrete shall be discharge within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 30 degrees C, 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

B. Before placing concrete, verify and obtain approval of Owner’s Agent that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

C. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by Owner's Agent.

D. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.

E. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit

concrete to avoid segregation.

F. Deposit concrete in forms in horizontal layers no deeper than 24 inches (600 mm) and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended in ACI 309R.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

G. Cold-Weather Placement: Comply with ACI 306.1 and as follows:
1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
3. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
4. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

H. Hot-Weather Placement: When hot-weather conditions exist, place concrete according to recommendations in ACI 305R and as follows:
1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option, at no additional cost to Owner.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

I. Concrete Placement When Water Is Present:

Concrete shall be deposited either by a tremie or concrete pump. The methods and equipment used shall be subject to approval. Concrete buckets shall not be used for underwater placement of concrete except to deliver concrete to the tremie. The tremie shall be watertight and sufficiently large to permit a free flow of concrete. The concrete shall be deposited so that it enters the mass of the previously placed concrete from within, displacing water with a minimum disturbance to the surface of the concrete. The discharge end of the pump line or tremie shaft shall be kept continuously submerged in the concrete. The underwater seal at start of placing shall not produce undue turbulence

in the water. The tremie shaft shall be kept full of concrete to a point well above the water surface. Placement shall proceed without interruption until the concrete has been brought to the required height. The tremie shall not be moved horizontally during a placing operation, and a sufficient number of tremies shall be provided so that the maximum horizontal flow of concrete will be limited to 0.15 feet. Concrete shall not be deposited in running water or in water with a temperature below 35 degrees F.

J. Mixes for integrally colored concrete shall have pigment added early enough to ensure complete dispersal and uniform color, but not less than 15 minutes before placing.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.
   1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.
   2. Do not apply rubbed finish to smooth-formed finish.

3.10 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the methods indicated under 3.8D.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with one of the following materials:
      a. Water.
      b. Continuous water-fog spray.

c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture- retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer recommends for use with floor coverings.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.11 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Owner's Agent. Remove and replace concrete that cannot be repaired and patched to Owner's Agent's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 (1.2-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities,

cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension in solid concrete but not less than 1 inch (25 mm) in depth. Make edges of cuts perpendicular to concrete surface.
2. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
3. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
4. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Owner's Agent.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 100 cu. yd. (38 cu. m) or fraction thereof.
    a. When frequency of testing will provide fewer than five compressive- strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or when 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
6. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of four standard cylinder specimens for each composite sample. Cast and field cure one set of four standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39; test two laboratory-cured specimens at 7 days and two at 28 days.

a. Test two field-cured specimens at 7 days and two at 28 days.
b. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at age indicated.

C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

D. Strength of each concrete mix will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

E. Test results shall be reported in writing to Owner's Agent, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Owner's Agent but will not be used as sole basis for approval or rejection of concrete.

G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as determined by Owner's Agent. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as determined by Owner's Agent.

H. Pole Foundation Construction will be inspected by Owner’s Agent for conformance with Contract Documents.

3.14 POLE FOUNDATIONS

A. Construct all concrete foundations in accordance with the tolerances specified in ACI 117.

B. Locate each foundation within one inch of its planned location, as indicated on the Project Drawings or as approved by the Owner’s Agent.

C. Axis of the foundations shall not be out of plumb more than one percent of its excavated depth.

D. Install each foundation with the correct diameter and length indicated on the Project Drawings. If it is greater in size, avoid interference with utilities or other work and obtain approval from Owner’s Agent.

E. Install each anchor bolt within the tolerances indicated herein.

F. Locate the anchor bolt assembly within its correct offset dimension and vertical position, as indicated in the Project Drawings. Determine anchor bolt positions relative to the offset dimensions from the vertical and horizontal base lines, or track center line.

G. Locate each anchor bolt assembly within two degrees of its correct orientation, as indicated on the Project Drawings.

H. The top of concrete of each pole foundation shall be within one-half inch of its correct elevation, as indicated on the Project Drawings.

I. Steel trowel all exposed, rough concrete surface to produce a smooth, dense surface. Finish foundation top with 1% slope, unless otherwise indicated on the Project Drawings.

J. Replace non-compliant or out-of-tolerance foundations at no additional cost to Owner.

K. Protect projecting and exposed surfaces from injury during entire construction period.

L. Protect anchor bolts and embedded items with tape and cap of weak grout after steel template is removed. Remove grout just prior to pole installation.

M. See Section 02225, Paragraph 3.15 and Section 02230, Paragraph 3.3 for additional requirements.

3.15 DAMPPROOFING

A. Mop apply one heavy coat of asphalt dampproofing to soil side of retaining walls and planter walls from top of wall footing to a minus 2 inches below finished soil grade.

END OF SECTION 03300

SECTION 03480

PRECAST CONCRETE UTILITY STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes design and construction of concrete structures. Structures may be plant-precast or cast-in-place concrete, at Contractor's option.

B. Related Sections:
   1. Section 03300 - Cast-in-Place Concrete.

1.2 REFERENCES

A. ACI 301 (American Concrete Institute) - Structural Concrete for Buildings.

B. ACI 318 (American Concrete Institute) - Building Code Requirements for Structural Concrete.

C. ACI 350R (American Concrete Institute) – Environmental Engineering Concrete Structures.

D. ASTM C76 – Reinforced Concrete Pipe

E. ASTM C478 – Precast Reinforced Concrete Manhole Sections.

F. ASTM A497 – Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

G. ASTM A615 – Deformed and Plain Billet – Steel Bars for Concrete Reinforcement.

H. ASTM C923 – Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.

I. CBC (State of California) California Building Code (Latest Edition).

J. PCI MNL-116 (Precast/Prestressed Concrete Institute) Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.

1.3 MODIFICATION OF REFERENCES

A. Accomplish work in accordance with ACI publications except as modified herein. Consider the advisory or recommended provisions to be mandatory, as though the word "shall" had been substituted for the words "should" or "could" or "may," wherever they appear.

1.4 DESIGN REQUIREMENTS

A. The Contractor, or his Agent, shall design all precast concrete utility structures in accordance with CBC and ACI 350R, except as modified herein.

B. Loads: Design structures for following loads unless otherwise indicated or specified.
   1. Dead Loads: Design for structure self weight and superimposed dead loads from supported materials and constructed items indicated.
   2. Live Loads: 100 psf on all gratings, catwalks, slabs and roofs.
   3. Traffic Loads: HS-20-44 vehicle load per AASHTO Standard Specifications for Highway Bridges on gratings, slabs and roofs where indicated or specified.
   4. Lateral Earth Pressure: Design for an equivalent fluid pressure of 85 psf. Include a 200 psf vertical surcharge where traffic loads are indicated or specified.
   5. Equipment Loads: As indicated.
   6. Wind Loads: In accordance with CBC on exposed portions of structures, 80 mph basic wind speed, Exposure C, I = 1.0.
   7. Seismic Load: In accordance with CBC, Zone 4, I = 1.0.
   8. Special Loads: In accordance with CBC, Tables 16A-B.

C. Hydrostatic Pressures and Buoyancy: Design for interior water and exterior water (groundwater) surface elevations indicated. Design walls supporting both interior water loads and exterior earth and/or groundwater loads to support both the full effect of interior water pressures and the full effect of the maximum exterior pressure, without considering that one load could minimize the effect of the other. Assume all water-containing structures to be empty for buoyancy and external pressure calculations. Design structures so that a minimum factor of safety of 1.1 for resisting buoyancy is achieved.

D. Minimum Reinforcement: Per ACI 350R.

E. Serviceability for Sanitary Exposures: Design structures for normal sanitary exposures in accordance with ACI 350R, unless severe environmental exposure is otherwise indicated or specified.

F. Joints: Permitted only where indicated, unless otherwise approved in writing by, and at sole discretion of Owner’s Agent. Design all joints to be watertight in accordance with ACI 350R or as otherwise indicated.

1.5 SUBMITTALS

A. Submit the following in accordance with Section 01330 – Submittal Procedures.

B. Shop Drawings: Indicate layout, fabrication details, reinforcement, connection details, support items, dimensions, openings and relationship to adjacent materials. Drawings shall be sealed by a California registered civil engineer.

C. Submit piping/valving layouts to confirm structure dimensions.

1.6 QUALITY ASSURANCE

A. Design concrete structures under direct supervision of a civil engineer experienced in design of this work and licensed in the State of California.

B. Perform plant precast work in accordance with PCI MNL-116.

1.7 DELIVERY, STORAGE, AND HANDLING (PRECAST CONCRETE)

A. Product storage and handling requirements to comply with manufacturers recommendations.

B. Handle precast members in position consistent with their shape and design. Lift and support only from support points.

C. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

D. Protect members to prevent staining, chipping, or spalling of concrete.

1.8 COORDINATION

A. Coordinate concrete structure design and construction with design fabrication and installation of grating, covers, railings, gates, valves, equipment and other related construction.

B. Contractor shall provide detailed layouts of all pipe and fittings within utility structures and confirm spatial requirements and clearance before designing structure.

PART 2 PRODUCTS

2.1 MATERIALS

A. Concrete and Reinforcement: In accordance with Section 03300 – Cast-in-Place Concrete.

B. Joints in walls for precast structures, such as wet wells and manholes, shall be tongue and groove, flush on inside and outside across the joint. No bell and spigot joints allowed in these cases.

2.2 FABRICATION (PRECAST CONCRETE)

A. Fabrication procedure to conform to PCI MNL-116.

B. Maintain plant records and quality control program during production of precast members. Make records available upon request.

C. Ensure reinforcing steel, anchors, inserts, plates, angles, and other cast-in items are embedded and located as indicated.

D. Tolerances: Conform to PCI MNL-116.

E. Source Quality Control: Sample and test concrete in accordance with Section 03300 – Cast-in-Place Concrete.

2.3 SOURCE QUALITY CONTROL (PRECAST CONCRETE)

A. Perform compressive strength, air entrainment, and slump tests as specified in Section 03300 – Cast-in-Place Concrete for all precast concrete structures.

2.4 COVERS

A. Covers shall be durable Hot Dipped Galvanized, manual opening as commercially manufactured and provided as traffic rated, unless otherwise indicated or specified.

PART 3 EXECUTION

3.1 FORMWORK

A. Construct formwork and install waterstops and accessories in accordance with Section 03300-Cast-in-Place Concrete.

3.2 REINFORCEMENT

A. Place reinforcement in accordance with Section 03300-Cast-in-Place Concrete.

3.3 CONCRETE

A. Place, finish, cure, protect and repair concrete in accordance with Section 03300-Cast-in- Place Concrete.

3.4 PRECAST STRUCTURES

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

B. Do not install structures under site conditions known to result in loads heavier than that for which the structure was designed.

C. Inspect precast concrete structures immediately prior to placement in the excavation to verify that they are internally clean and free from damage. Remove damaged units from the construction site and replace at no additional cost to the Owner.

D. Excavation and Backfill:
   1. Excavate for manholes and drainage structures in accordance with Section 02225 in the location and to depth shown. Provide clearance around the sidewalls of the structure as required for construction.

2. If groundwater is encountered, prevent accumulation of water in excavations. Place manholes or drainage structures in a dry trench.
3. Where the possibility exists of a watertight structure becoming buoyant in a flooded excavation, take necessary steps to avoid flotation of the structure.

E. Place base pad, trowel top surface level.

F. To ensure safety, lift precast structures at the lifting points designated by the manufacturer.

G. When lowering manholes and drainage structures into the excavations and joining pipe to the units, take precautions to ensure that the interior of the pipeline and structure remains clean.

H. Set precast structures so that they firmly and fully bear on crushed stone bedding, compacted in accordance with the provisions of Section 02225 or on other support system shown on the Contract Drawings.

I. Assemble multi-section structures by lowering each section into the excavation. Lower, set level, and firmly position the base section before placing additional sections.

J. Ensure joint integrity by removing all foreign materials from joint surfaces and verifying that sealing materials are placed properly. Avoid misalignment by using guide devices affixed to the lower section.

K. Joint sealing materials may be installed at the site or at the manufacturer's plant.

L. Verify that manholes and drainage structures installed satisfy required alignment and grade.

M. Remove knockouts or cut structure to receive piping so as not to create openings more than that required to receive pipe. Fill annular space with mortar.

N. Cut pipe to finish flush with interior of structure.

3.5 FIELD QUALITY CONTROL

A. Concrete
1. Sample and test concrete in accordance with Section 03300 – Cast-in-Place Concrete.

END OF SECTION

SECTION 13111

CATHODIC PROTECTION
of
RECYCLED AND LOW PRESSURE WATER PIPELINES

PART I -GENERAL

1.1 SCOPE

The Contractor shall furnish all materials, install all equipment and provide all labor necessary to complete the work shown on the drawings and or/listed below and all other work and miscellaneous items not specifically mentioned but reasonably inferred, including all accessories and appurtenances required for a complete system. The intent of this specification is to provide for a complete, functional cathodic protection system for the Recycled and Low Pressure Water Pipelines in the Candlestick Point Development, Sub-Phase CP-01 Project in San Francisco, CA .

1.2 WORK INCLUDED

Work included in this section consists of the components of the cathodic protection system, including magnesium anodes, cables, insulating joints, test stations and any other work necessary to complete the installation. The scope of work includes, but not limited to, the following:

A. Cathodic protection of ductile iron pipe and fittings associated with the Recycled and Low Pressure Water Pipelines.

B. Cathodic protection of any copper and ductile iron laterals.

C. Encasement of all ductile iron pipelines and fittings associated with the Recycled and Low Pressure Water referenced Pipelines in polyethylene.

D. Tape wrapping of all copper and ductile iron laterals.

E. Bonding of non-welded pipe joints.

F. Trenching, drilling, and other excavation.

G. Installation of magnesium anodes, cables and test stations.

H. Backfill and compaction of backfill.

I. Electrical isolation of the new pipelines from foreign pipelines and above grade structures utilizing insulating joints.

J. Electrical isolation of copper and ductile iron laterals from the water main and the water meters and building connections.

K. Provide shop drawings, reports, permits, and obtain Owner’s Agent approval where

required.

L. Correction of all deficiencies.

M. Cleanup and restoration of surface.

N. The work shall include the provision of all materials, equipment, and apparatus not specifically mentioned herein or noted on the plans, but which are obviously necessary to complete the work specified.

1.3 QUALITY ASSURANCE

A. GENERAL

All work shall be performed to the satisfaction of the Owner's Agent.

B. MATERIALS

The Contractor shall not substitute for the specified materials unless approved by the Owner's Agent.

C. TESTING

Electrical continuity of the pipelines, proper operation of anodes, test leads and all other cathodic protection components shall be tested by the Contractor and approved by the Project Corrosion Engineer, in order to ensure proper installation and operation. The Contractor shall be responsible for correction of all deficiencies identified by the testing and all costs incurred for retesting prior to final acceptance.

D. COMPACTION

Compaction of backfill for anodes and trenches shall match the existing conditions and shall be approved by the Owner's Agent.

1.4 REQUIREMENTS

A. All buried metallic pipes, fittings and appurtenances associated with the water main pipelines will be encased in polyethylene as specified elsewhere.

B. All buried metallic pipes, fittings and appurtenances associated with the water pipeline laterals between the main and the meters, and from the meter to the limit of work will be primed and tape wrapped as specified elsewhere

C. Galvanic cathodic protection shall be installed on all buried metallic pipe, valves, fittings, risers, casings, laterals and appurtenances.

D. All rubber gaskets, mechanical joints and flexible couplings shall be bonded along the entire buried length of metallic pipe.

E. Insulating joints shall be installed to electrically isolate the subject pipelines from existing and foreign pipelines, water meters, water laterals and above grade structures.

F. Test stations shall be installed at all locations designated on the plans.

1.5 CODE REQUIREMENTS

All materials, workmanship, and installation shall conform to all requirements of the legally constituted authority having jurisdiction. These authorities include, but are not limited to, the latest revision of the State of California, Department of Industrial Relations, Division of Industrial Safety Orders of the Industrial Accident Commission, and all other applicable State, County, or City codes and regulations. Nothing in the drawings or specifications is to be construed to permit work not conforming to these regulations and codes. Where larger size or better grade materials than required by these regulations and codes are specified, the specifications and drawings shall have precedence.

1.6 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. In case of a conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

A. American Society of Testing and Materials (ASTM)

B. National Electrical Manufacturers Association (NEMA)

C. American Water Works Association (AWWA)

D. National Association of Corrosion Engineers (NACE)

E. American National Standards Institute (ANSI)

1.7 CONTRACTOR SUBMITTALS

Prior to commencing work, the Contractor shall submit for approval by the Owner's Agent copies of the following items in accordance with submittal procedures:

A complete list of cathodic protection equipment and material, including name and manufacturer, catalog number, size, finish and any other pertinent data necessary for proper identification and to determine conformance with specifications.

1.8 INTERFERENCE AND EXACT LOCATIONS

The Contractor shall coordinate and properly relate this work to the site and to the work of all trades. The general locations of the facilities are shown on the drawings. However, the Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, verify existing conditions in the field, determine the exact locations of existing pipelines and structures and advise the Owner's Agent of any discrepancy that may prevent or hinder the specified work from being completed. The Contractor shall be solely responsible for location and marking underground structures so as to avoid damage during construction.

PART 2-PRODUCTS

2.1 GENERAL

All materials shall conform to the requirements set forth herein or as designated on the drawings, unless otherwise specified. All materials must be new, free from defects, and shall be of the best commercial quality for the purpose specified. The Contractor shall furnish all necessary items and accessories not shown on the drawings or specified herein, but which are required to fully carry out the specified intent of the work, without additional cost to the Owner.

2.2 MAGNESIUM ANODES

A. Magnesium anodes for the ductile iron pipeline/fittings shall be High Potential, *Magnesium*. The bare magnesium ingot shall weigh 32-pounds and shall measure 5.5-inches by 5.75-inches by 19 & 7/8-inches long. The packaged anode shall weigh 70 pounds and shall be 8-inches in diameter and 28-inches long. Each anode shall be cast with a steel core, and the core shall protrude from one end and shall be of sufficient length to permit attachment of a lead wire.

B. Each anode shall conform to the following chemical composition:

Chemical Composition	
Aluminum	0.01% Max.
Manganese	0.5 to 1.3%
Copper	0.02% Max
Silicon	0.05% Max.
Iron	0.03% Max.
Nickel	0.001% Max.
Other Impurities, Each	0.05% Max.
Magnesium	Balance

C. Each anode shall be furnished with a lead wire attached to one end of the steel core, and the wire shall be of sufficient length to attach to the test station as shown on the drawings. The wire shall be connected to the steel core by silver soldering, and the connection shall be mechanically secured before soldering. The entire connection shall be insulated with an electrical potting compound. The cable attached to the anode shall be No. 10 AWG, Type RHW-2/USE-2 stranded, single conductor copper.

D. The anode shall be prepackaged in a permeable cloth bag filled with a mixture of 75% ground hydrated gypsum, 20% powdered bentonite, and 5% anhydrous sodium sulfate. Backfill shall have a grain size so that 100% is capable of passing through a 100-mesh screen. The mixture shall be firmly packed around the anode within the cloth bag by means of adequate vibration so that the magnesium ingot is completely surrounded with a minimum 1 in. of backfill material.

2.3 CABLES

A. Cables used for joint bonding shall be single conductor, stranded copper, Type CP,

insulated for 600 volts with High Molecular Weight Polyethylene (HMWPE) in accordance with the requirements of ASTM D 1248, Type 1, Class A, Category 5, Grades E4 & E5 with tensile strengths per J1 and J2.

B. All cables for anodes and test stations shall be Type RHW-2/USE-2, stranded, copper, sized as shown on the drawings and shall meets or exceeds UL Standard 44 (for RHW-2), UL Standard 854 (for USE-2), Federal Specification A-A-59544, and requirements of the National Electrical Code..

C. Insulation Color
   1. Project Pipe: White
   2. Existing Pipe: Red
   3. Anode or Anode Header Cable: Black

2.4 CABLE-TO-PIPE CONNECTIONS

A. Ductile Iron Pipe
   1. All cable connections to the ductile iron pipe or fittings and steel pipelines shall be accomplished utilizing an exothermic welding process such as "Cadweld" by Erico Products, Inc., "Thermoweld" by Continental Industries, Inc., or approved equal. Each cable shall be fitted with a copper sleeve for accomplishing the weld and cartridge, sleeves and molds for each weld shall be furnished by the same manufacturer. All materials for welding shall be sized and in accordance with recommendations in manufacturers' literature. Exothermic welds for the ductile iron fittings shall be made using the weld metal for cast iron pipe.

B. Copper Pipe
   1. All cable connections to copper pipe shall be accomplished utilizing a brass ground clamps.

C. Force Balanced Expansion Joints
   1. All cable connections to the ductile iron force balanced expansion devices shall be accomplished by pin brazing. Pin brazing equipment based upon Electric-arc silver soldering using a specially designed portable Pin Brazing unit, a hollow brazing pin containing silver solder and flux shall be utilized for cable-to-structure connections. The unit may be battery powered or powered with a welding generator. Battery pack, pins with fuse wire, ceramic ferrules and cable lugs shall be in accordance with the manufacturer's recommendations for each wire size and pipe or fitting size and material. Brazing materials and equipment shall be the product of a single manufacturer. All material and equipment utilized for brazing shall be from one manufacturer.
      a. BAC - GMC Electrical, Ontario, CA.
      b. Farwest Corrosion Control, Hayward, CA.

2.5 CABLE-TO-PIPE COATING MATERIAL

Epoxy used for sealing the cable to pipe connection shall be Durcon-164, manufactured by the Duriron Company; Scotchcast Resin No. 4, manufactured by 3-M Company; or CC-1 Potting Compound, manufactured by PSI Products.

2.6 TEST STATION

A. Ground level test stations shall be Christy G5 traffic box with 1.5-inch high iron grade ring per unit and a cast iron lid as shown on the drawing.

B. The cover shall be manufactured and engraved with the following markings for easy identification:
   1. “CP-TEST" for LPW lines
   2. “ANODE” for the RW lines.

2.7 TERMINAL BOXES

A. Type
   1. Terminal boxes shall be locking type, constructed of high-impact, molded Lexan plastic, Model "Big Fink", as manufactured by Cott Manufacturing Company or approved equal.

B. Hardware
   1. The test box shall be provided with sufficient hardware and terminals for each cable as shown on the drawings. All test station hardware, including nuts, bolts and shorting straps shall be nickel-plated brass. Terminal Boxes for the anode test stations shall be supplied with 6 amp, 0.01 ohm shunts.

C. Color:
   1. The terminal boxes for the LPW lines shall be blue in color.
   2. The terminal boxes for the RW lines shall be orange in color.

2.8 CABLE WARNING TAPE

All buried test station and anode cables shall have plastic warning tape installed a minimum of 12 in. above the top of the cables for the entire buried length of the cables. The warning tape shall be 4 in. wide and shall be yellow with black lettering with the legend "CAUTION, CATHODIC PROTECTION CABLES BURIED BELOW" in 3 in. high lettering printed at a minimum of seven foot intervals along the entire buried length of the cable.

2.9 CABLE IDENTIFICATION TAGS

All cables in the terminal boxes shall be identified. The identification tags shall be white plastic "zip-tie" type straps with a plastic tab of sufficient size to allow the pipeline station to be written on the tab with a permanent felt tip marker.

2.10 INSULATING FLANGED JOINTS

The insulating flange kit shall be for water service, and suitable for wet and dry locations. Each insulating flange set shall consist of a full-face central gasket, a full-length sleeve for each flange bolt, and two insulating washers with two steel washers for each bolt. The ring-type central gasket shall be 1/8-inch thick sheet packing, having a dielectric constant of 300 volts per mil, minimum and shall be in compliance with NSF-61, such as G-10 manufactured by PSI or Gylon 3505 manufactured by Garlock Sealing Technologies. Bolt sleeves and insulating washers shall be G-10. The complete assembly shall have an ANSI pressure rating equal to that of the flanges between which it is installed.

2.11 BURIED INSULATING JOINT COATING MATERIAL

Coatings for buried insulating flanges and insulating couplings shall consist of a non-conductive, petrolatum-based coating system, such as Trenton Wax Tape #1 by The Trenton Corporation, or equal. The coating system shall consist of a prime coat as an initial surface preparation to displace moisture on the surface and to improve adhesion of the wax tape. A wrap material shall be used to provide a smooth contour on the surface of the joint as well as for protection of the substrate. An over wrap shall be used as a final coating to provide increased mechanical strength of the coating. The prime coat shall be a petrolatum material with corrosion inhibitors and plasticizers. The wrap coat shall be a synthetic fabric saturated with a blend of petroleum wax, plasticizers and corrosion inhibitors. The over wrap shall be plasticized, self-adhesive PVC tape.

2.12 BITUMASTIC Coating FOR FLANGE HARDWARE

Coating for all buried bolts, nuts and metallic washers shall be Bitumastic 300M, coal tar mastic coating, as manufactured by Carboline or approved equal.

PART 3--EXECUTION

3.1 GENERAL REQUIREMENTS

All materials, workmanship and installation shall conform to all requirements of the legally constituted authority having jurisdiction. These authorities include, but are not limited to, the latest revision of the State of California, Department of Industrial Relations, Division of Industrial Safety, Electrical Orders; The National Electric Code, General Construction Safety Orders of the Industrial Accident Commission; and all other applicable State, County, or City codes and regulations. Nothing in the drawings or specifications is to be construed to permit work not conforming to these regulations and codes. Where larger size or better grade materials than required by these regulations and codes are specified, the specifications and drawings shall have precedence.

3.2 STORAGE OF MATERIALS

All materials and equipment to be used in construction shall be stored in such a manner to be protected from detrimental effects from the elements. If warehouse storage cannot be provided, materials and equipment shall be stacked well above ground level and protected from the elements with plastic sheeting or other method as appropriate.

3.3 MAGNESIUM ANODES

A. Anodes shall be installed in the trench horizontally or vertically as shown in the drawings after excavation to proper depth, equal to the bottom of the pipeline, a minimum of 3 feet from fittings and a minimum of 5 feet from the pipelines. Spacing between anodes shall be 10 feet (minimum) if multiple anodes are installed at a single test station location as shown on the drawings. Prior to placing anodes in the trench or hole, paper or plastic bags shall be removed, but the cloth bag shall remain around the anode. Care shall be exercised during installation to prevent damage to the cloth bag and loss of backfill material. After placing anodes in the trench, native soil, free of rocks and other foreign objects shall be placed around the anode to a minimum cover of one foot above the anode. Remainder of the trench shall then be backfilled with native soil. During installation, anodes shall not be

supported or handled by use of attached wires.

B. The number of anodes to be installed at each test station is designated on the drawings.

3.4 CABLES

Cables buried in the ground shall be direct buried and shall be laid straight, without kinks. The cable shall have a minimum cover of 30 in. Each cable run shall be continuous in length and free of joints or splices. Care shall be exercised during installation to avoid punctures, cuts, and similar damage to insulation. Any damage to insulation will require replacement of the entire cable length. Backfill surrounding the cables shall be native soil free of foreign materials. Cable warning tape shall be installed 12-inches above the entire buried length of the cable.

3.5 CABLE-TO-PIPE CONNECTION

A. Exothermic Welds for Ductile Iron Pipe

1. Cable-to-pipe connections shall be installed in the manner and at the locations shown on the drawings. Coating materials shall be removed from the pipe surface over an area just sufficient to make the connections. The surface shall be cleaned to white metal by grinding or filing prior to welding the conductor. Grinding with resin-impregnated wheels shall not be allowed. The conductor shall be welded to the pipe by the exothermic process with a copper sleeve fitted over the conductor, and only sufficient insulation shall be removed from the conductor to allow placing in welding mold. After the weld has cooled, all slag shall be removed and the weld shall be tested with a sharp blow from a 22-ounce hammer to assure proper metallurgical bond. All defective welds shall be removed and replaced. All exposed surfaces of copper and steel shall be covered with a minimum thickness of ¼ inch of insulating materials as shown on the drawings. The cable to pipe connections shall be tested with a low resistance ohmmeter by the Contractor and approved by the Owner's Agent prior to backfill. Cable to pipe connections backfilled prior to testing shall be rejected.

B. Pin Brazing for Force Balanced Expansion Joints

1. Cut wire with a wire cutter to prevent deforming the wire ends. Do not deform the wire. Remove only enough insulation from the wire to allow the brazed connection to be made. The surface of the steel structure shall be ground or filed to a bright, shiny, clean and dry surface before brazing the wire connection. The attachment of the wire to the structure shall be made as indicated on the drawings. The wire is to be held at a 90 degree angle to the surface when brazing. Only one wire is to be attached with each braze. All wire to structure braze shall be a minimum of 6 inches apart. As soon as the braze has cooled, the brazed connection shall be tested for strength by striking a sharp blow with a two-pound hammer while pulling firmly on the wire. All unsound brazed connections are to be redone and retested. Assure that the area to be coated is thoroughly cleaned by wire brushing. All exposed surfaces of copper and steel and surrounding surface shall be cleaned of contaminants and covered with a minimum thickness of 1/4-inch of Propoxy 20 epoxy putty. The cable to pipe connections shall be tested with a low resistance ohmmeter by the Contractor and approved by the Owner's Agent prior to backfill. Cable to pipe connections backfilled prior to testing shall be rejected.

3.6 TEST STATIONS

Test stations shall be installed at locations designated on the drawings and at all anode installation locations. All test stations shall be installed in the sidewalk in the field. The terminal end of each cable shall be identified with the structure identification using the permanent cable identification tags.

3.7 JOINT BONDING

All non-welded rubber gasket joints, mechanical joints, flange joints and threaded joints shall be bonded with a #4 or #8 AWG/HMWPE stranded copper cable, as shown on the drawings. The overall length of the conductor shall permit maximum movement of the pipe joint without transferring any tensile stress to the cable, per pipe manufacturer's recommendations. The bonded pipe sections shall be tested for continuity, prior to backfilling.

3.8 INSULATING FLANGED JOINTS

All insulating components of the insulating flanged gasket set shall be cleaned of all dirt, grease, oil and other foreign materials immediately prior to assembly. Bolt holes in mating flanges shall be properly aligned at the time bolts and insulating sleeves are inserted to prevent damage to the insulation. After flanged bolts have been tightened, each insulating washer shall be inspected for cracks or other damage. All damaged washers shall be replaced. After assembly, resistance between each bolt and flange shall be measured with an approved ohmmeter, and the minimum resistance shall be 50,000 ohms. Where the insulating joint is assembled in the shop and shipped as a unit, resistance shall be measured in the shop between the flanges and between each bolt and flange and shall meet the above requirements. In addition the completed assembly shall be tested with a flange insulation tester such as Gas Electronics Model 601 or equal for the integrity of insulation. In cases where the insulating flange is assembled in the field the completed assembly shall be tested with a flange insulation tester such as Gas Electronics Model 601, or equal prior to backfilling. All buried insulating flanged joints shall be coated as shown on the drawings and specified below.

3.9 COATING INSULATING FLANGED JOINTS

Surfaces shall be cleaned of all dirt, grease, oil and other foreign materials immediately prior to coating. Remove loose rust, paint and other foreign matter in accordance with SSPC SP2 or SP3. A prime coating shall be applied in a uniform coating over the entire surface to be wrapped. A liberal coating shall be applied to threads, cavities, shoulders, pits and other irregularities. A fill coating shall be molded and packed onto irregular surfaces such as flanges, valves or flexible couplings to create a smooth profile prior to wrapping. A wrap coating shall be spirally wrapped using a minimum of 55 percent overlap to ensure a double thickness of material. At the completion of each roll the overlaps shall be smoothed by hand in the direction of the spiral to ensure sealing of the overlap. A 2-inch overlap shall be maintained when overlapping one roll with the end of a new roll. Overlap shall occur on the top half of the pipeline. A guard coating shall be spirally over-wrapped using a 55 percent overlap to ensure a double coating.

3.10 FIELD COATING OF BURIED FLANGE HARDWARE

All buried nuts and bolts shall be coated with bitumastic prior to polyethylene encasement. After flange hardware is installed use wire brush, power brush or an abrasive cleaning pad to remove all loose material, dirt and grime from substrate to a minimum cleanliness of SSPC SP2. Apply

Bitumastic coating liberally with a medium bristle brush to the extent that all surfaces are completely covered with no bare spots visually evident. Coat exposed surfaces of bolts, washers and nuts, giving special attention to the bottom-side surfaces. Follow the manufacturer's recommendations for drying times required before polyethylene encasement and backfill.

3.11 ENERGIZING AND TESTING

After the contractor has completed the installation of the cathodic protection system, the system will be energized, tested, and adjusted by the Project Corrosion Engineer to assure conformance with the specifications. The tests will include electrical continuity of the pipeline, electrical isolation with laterals and other structures as shown on the drawings, pipe-to-soil potential measurements at all test stations, laterals, fire hydrants and all available test points. Pipe-to-soil potentials on both sides of any insulating flanges, anode current output, etc. All insulating flanges shall be tested with a flange insulation tester such as Gas Electronics Model 601, or equal prior to backfilling. All bonded pipe sections shall be tested for electrical continuity prior to backfilling. All testing results shall be reviewed and approved by the Owner’s Agent. A polarized potential of -0.85 volts Vs a copper sulfate electrode at all available test locations shall be considered as adequate level of cathodic protection. Anode current output shall not exceed a value of 60 mA per anode. Excessive anode current shall be controlled utilizing fixed power resistors. Any and all deficiencies shall be corrected by the Contractor at his cost and retested prior to final acceptance. All retesting shall be at the Contractor's expense.

END OF SECTION

SECTION 16010

ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 CONDITIONS & REQUIREMENTS

A. Department of Public Works (DPW) Order No. 176,707 "Regulations for Excavating and Restoring Streets in San Francisco", approved March 26, 2007.

1.2 DEFINITIONS (APPLICABLE TO DRAWINGS AND SPECIFICATIONS)

A. Above Grade: Not buried in ground and not embedded in concrete slab on grade.

B. Below Grade: Buried in ground or embedded in concrete slab on grade.

C. Concealed: Inside building above grade and located within walls, furred spaces, crawl spaces, attics, above suspended ceilings, etc. In general, any item not visible or directly accessible.

D. Connect: Complete hookup of item with required services, including conduit, wires and other accessories.

E. Exposed: Either visible or subject to mechanical or weather damage, indoors or outdoors, including areas such as mechanical and storage rooms. In general any item that is directly accessible without removing panels, walls, ceilings, or other parts of structure.

F. Furnish: Supply and deliver complete.

G. Install: Place, secure and connect as required to make fully operational.

H. Provide: Furnish and install as defined above; perform work

I. Underground: Buried in ground, including under building slabs.

J. Use (verb): Furnish and install as defined above.

K. Wiring: Electrical raceway, conductors and connections.

1.3 SCOPE OF WORK

A. Furnish and install all materials and equipment and provide all labor required and necessary to complete the work shown on the drawings and/or specified in all Sections of Division 16 and all other work and miscellaneous items, not specifically mentioned, but reasonably inferred for a complete installation including all accessories and appurtenances required for testing the system. It is the intent of the contract documents that all systems be complete and ready for operation.

1.4 CODE COMPLIANCE

A. All work and materials shall comply with the latest rules, codes and regulations, including, but not limited to the following
   1. Occupational Safety and Health Act Standards (OSHA).
   2. NFPA #70 – National Electric Code (NEC), Latest Edition.
   3. NFPA #101 – Life Safety Code.
   4. City of San Francisco Electric Code, Latest Edition.
   5. Regulations of City and County of San Francisco Bureau of Light, Heat, and Power (BLHP).
   6. California Code of Regulations Title 8, Chapter 4, Subchapter 5, Electrical Safety Orders.
   7. Rules for Overhead Line Construction, General Order No. 95, California Utilities Commission.
   8. All other applicable Federal, State and local laws and regulations including GO128 and GO112C..
   9. Standard Plans (SPDPWSF) and Standard Specifications (SSDPWSF): City and County of San Francisco, Department of Public Works, Bureau of Engineering, Latest Editions.
   10. Caltrans Standard Specifications (CTSS) & Caltrans Standard Plans (CTSP), Latest Editions.
   11. Requirements and specifications of PG&E, PG&E Green Book – current effective edition.
   12. Requirements and specifications of AT&T [formerly Pacific Bell and SBC].
   13. Requirements and specifications of COMCAST [formerly AT&T Broadband].
   14. All other applicable requirements of communication and utility companies.
   15. American/Disability Act Accessibility Guidelines.
   16. California Building Code, Latest Edition.

B. Code compliance is mandatory. Nothing in these contract documents permits work not conforming to these codes. Where work is shown to exceed minimum code requirements, the Contractor shall comply with drawings and specifications.

C. No work shall be concealed prior to inspection and approval by Owner's Agent and proper authorities. If work is concealed without inspection and approval, the Contractor shall be responsible to reopen and restore the concealed areas, in addition to all required modifications.

1.5 LICENSE, FEES AND PERMITS

A. The Contractor shall confirm with General Contractor that all required permits are procured. See Construction Agreement.

1.6 CONDITIONS AT SITE

A. A site visit is required of all bidders prior to submission of bid. All bidders will be held to have familiarized themselves with all discernible conditions and no extra payment will be allowed for work required because of these conditions, whether specifically mentioned or not.

B. Facilities of other Utilities that are damaged as a result of this work shall promptly be repaired to the complete satisfaction of the respective Utility Company at no expense to the Owner.

1.7 DRAWINGS AND SPECIFICATIONS

A. All drawings and all Divisions of these specifications shall be considered as a whole and work of this Division shown anywhere therein shall be furnished under this Division.

B. Drawings are diagrammatic and indicate the general arrangement of equipment and wiring. Most direct routing of conduits and wiring is not assured. Exact requirements shall be governed by civil and structural conditions of the job. Consult all other drawings. Extra lengths of wiring or addition of pull or junction boxes, etc., necessitated by such conditions shall be included, in the contract cost.

C. The right is reserved to make a change up to ten feet in location of any outlet or equipment prior to rough in without increasing contract cost.

1.8 SAFETY AND INDEMNITY

A. Safety: The Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement will apply continuously and not be limited to normal working hours. See also Construction Agreement.

B. No act, service, drawing review or construction review by the Owner, or their Consultants is intended to include review of the adequacy of the Contractor’s safety measures, in, on, or near the construction site.

1.9 RECORD DRAWINGS

A. The Contractor shall submit scaled drawing(s) prior to installation of any proposed modifications to equipment layouts, device locations, conduit routing, or conductor groupings. Any approved modifications will be reissued to the Contractor as either a change order or clarification depending on value to the contract. The Contractor shall provide record drawings which incorporate all changes to the documents. Submit as-built drawings within 15 days after final inspection of joint trench installation and conduit proofing.

PART 2 - PRODUCTS

2.1 MATERIAL APPROVAL

A. The design, manufacture and testing of electrical equipment and materials shall conform to or exceed latest applicable NEMA, IEEE and ANSI standards.

B. All materials must be new and bear the UL label where applicable. Materials that are not covered by UL testing standards shall be tested and accepted by an independent testing laboratory or a governmental agency acceptable to the Owner's Agent

2.2 SUBMITTALS, SHOP DRAWINGS AND MATERIALS LIST

A. The Contractor shall submit shop drawings and product descriptive literature as specified for review. Quantity and procedure for submittals shall be as specified in Construction Agreement.

B. Material list shall only include items where a specific manufacturer is shown in the specifications. Where manufacturers are shown, material list shall include only one manufacturer for each type of equipment or system.

C. Purpose of review of submittals is for check of general compliance with information given in contract documents. Each review and/or addition of notations and comments does not relieve Contractor from compliance with requirements of project contract documents.

D. All proposed deviations from specifications shall be clearly listed under a prominent heading entitled “DEVIATIONS” for review by the Owner's Agent. Deviations not so listed may be disallowed before or after installation of equipment.

E. Contractor shall be responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes, and techniques of construction. Where dimensions of proposed equipment differ significantly from that shown on contract documents, Contractor shall submit scaled drawings showing proposed layout of equipment with shop drawing submittal.

2.3 DELIVERY, STORAGE AND HANDLING OF MATERIALS AND EQUIPMENT

A. All materials shall be delivered, stored and handled in a manner to prevent damage.

B. Equipment shall be protected from weather and dampness.

PART 3 - EXECUTION

3.1 WORKMANSHIP AND CONTRACTOR’S QUALIFICATIONS

A. Only quality workmanship will be accepted. Haphazard or poor installation practice will be cause for rejection of work.

B. A foreman shall be in charge of this work at all times.

3.2 COORDINATION

A. The work shall be coordinated with other trades and utilities to avoid conflict and to provide correct rough in and connection for equipment furnished under trades that require electrical connections. The Contractor shall inform Contractors of other trades of the required access to clearances around electrical equipment to maintain serviceability and code compliance.

B. The Contractor shall verify equipment dimensions and requirements with provisions specified under this Section. Check actual job conditions before fabricating work.

C. The Electrical Contractor shall participate in the preparation of coordination drawings, which are to be used by all trades for work coordination prior to start of any work. As a minimum Electrical Contractor shall furnish all necessary information, which are related to the size, elevation, routing, clearance requirement, etc. of electrical equipment and are connected under Division 16, to the General Contractor prior to installation of work. Special attention shall be given to areas containing work of many trades.

D. Prior to construction, contractor shall participate pre-construction meeting with all Joint Trench inspectors of all Occupants. All under-ground installation shall be inspected prior to back-fill and cover-up.

3.3 MANUFACTURER'S INSTRUCTIONS

A. Where the specifications call for an installation to be made in accordance with manufacturer's recommendations, a copy of such recommendations shall at all times be kept in the job superintendent's office and shall be available to the Owner's Agent.

B. Follow manufacturer's instructions where they cover points not specifically indicated on drawings and specifications. If they are in conflict with the drawings and specifications obtain clarification from the Owner's Agent before starting work.

3.4 QUALITY ASSURANCE

A. The Contractor shall provide a meaningful Quality Assurance program. To assist the Contractor in this program, the specifications contained herein are set forth as the minimum acceptable requirements. This does not relieve the Contractor from executing other Quality Assurance measures to obtain a complete operating facility within the scope of this project.

B. The Contractor shall insure that all workmanship, all materials employed, all required equipment and the manner and method of installation conforms to accepted construction and engineering practices, and that each piece of equipment is in satisfactory working condition to satisfactorily perform its functional operation.

3.5 CUTTING AND PATCHING

A. The Contractor shall provide all cutting and patching required for work of this Division. Coordination with General Contractor and other trades is imperative. The Contractor shall bear the responsibility for and the added expense of adjusting for improper holes, supports, etc.

3.6 FIELD TEST AND OPERATIONAL CHECK

A. General Scope
1. The Contractor shall perform the inspections and tests to determine the suitability for energization. Provide 1000V DC Megger test to all conductors and provide test results to Owner's Agent for review and approval.
2. It is the intent of these tests to ensure that all electrical equipment is operational within industry and manufacturer's tolerances and is installed in accordance with design specifications.

B. Failure to Meet Test
   1. Any system material or workmanship, which is found defective on the basis of acceptance tests, shall be reported directly to the Owner's Agent.
   2. Contractor shall replace the defective material or equipment and repeat the tests until the tests prove satisfactory, without additional cost to the Owner.

3.7 ACCEPTANCE DEMONSTRATION

A. Upon completion of the work, at a time to be designated by the Owner's Agent, the Contractor shall demonstrate for the Owner's Agent the operation of the installation, including any and all special items installed by him or installed under his supervision.

B. Allow 16 hours of demonstration time.

3.8 SERVICES REQUIRMENT

A. Contractor shall coordinate with PG&E to provide electrical service for the project.

3.9 REMOVING, REINSTALLING OR SALVAGING STREET LIGHTING EQUIPMENT

A. Removing, reinstalling or salvaging street lighting equipment shall be in accordance with CTSS Section 86-7, "Removing, Reinstalling or Salvaging Electrical Equipment," and the Contract Documents.

B. Damaged or Lost Equipment: The second paragraph of CTSS Section 86-7.01, "Removing Electrical Equipment," is amended to read:
   1. If existing equipment required to be salvaged is damaged by the Contractor or by others when such equipment is within the contractor's control, repairs shall be made in accordance with SSDPWSF Section 105.03.
   2. If such equipment is lost prior to or during delivery to the City, deductions shall be made from final Payment in accordance with the following table:

EQUIPMENT	DEDUCTION
Light Standard	$400 each

   3. If repairs are not to the satisfaction of the Owner's Agent, the respective equipment shall be considered lost. Deduction from final Contract Payment shall be made in accordance with the above table.
   4. The listing of the above equipment and payment adjustments does not preclude the Owner from making claims or adjustments for other existing equipment that may be lost or damaged by the Contractor.

C. Delivery of Salvaged Equipment

1. The Contractor shall deliver all existing street lighting equipment specified or shown to be salvaged as City property to the Bureau of Light, Heat and Power at 639 Bryant Street, San Francisco.
2. The Contractor shall furnish the Owner's Agent with receipts dated and signed by City Yard personnel stating the quantity, description, and condition of materials delivered.
3. Appointments for the delivery of salvaged lighting standard to the Bureau of Light, Heat, and Power 415-495-5576 shall be made twenty-four (24) hours in advance.

END OF SECTION

APPENDIX A

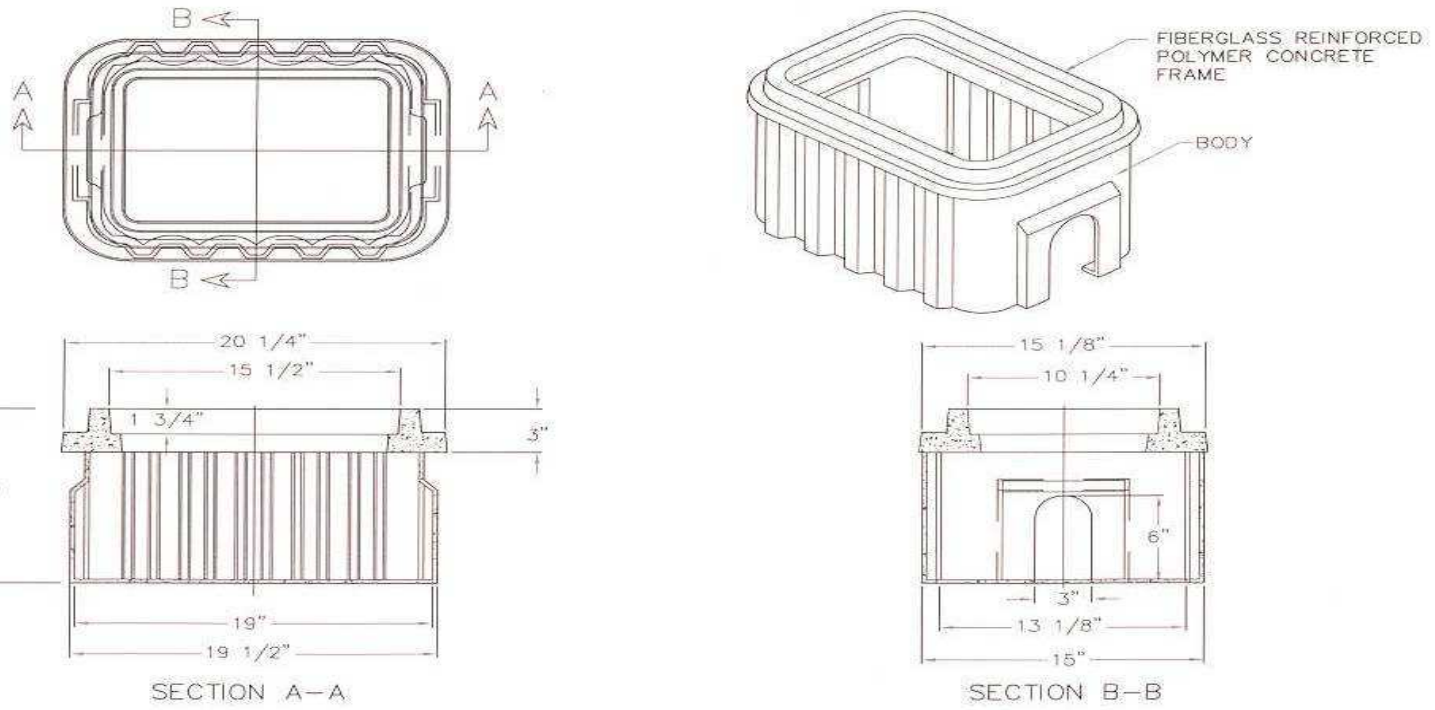
SFWD STANDARD DRAWINGS

Note: Standard Drawings are superceded where in conflict with requirements and details provided in Technical Specifications, Project Drawings, and Special Provisions.

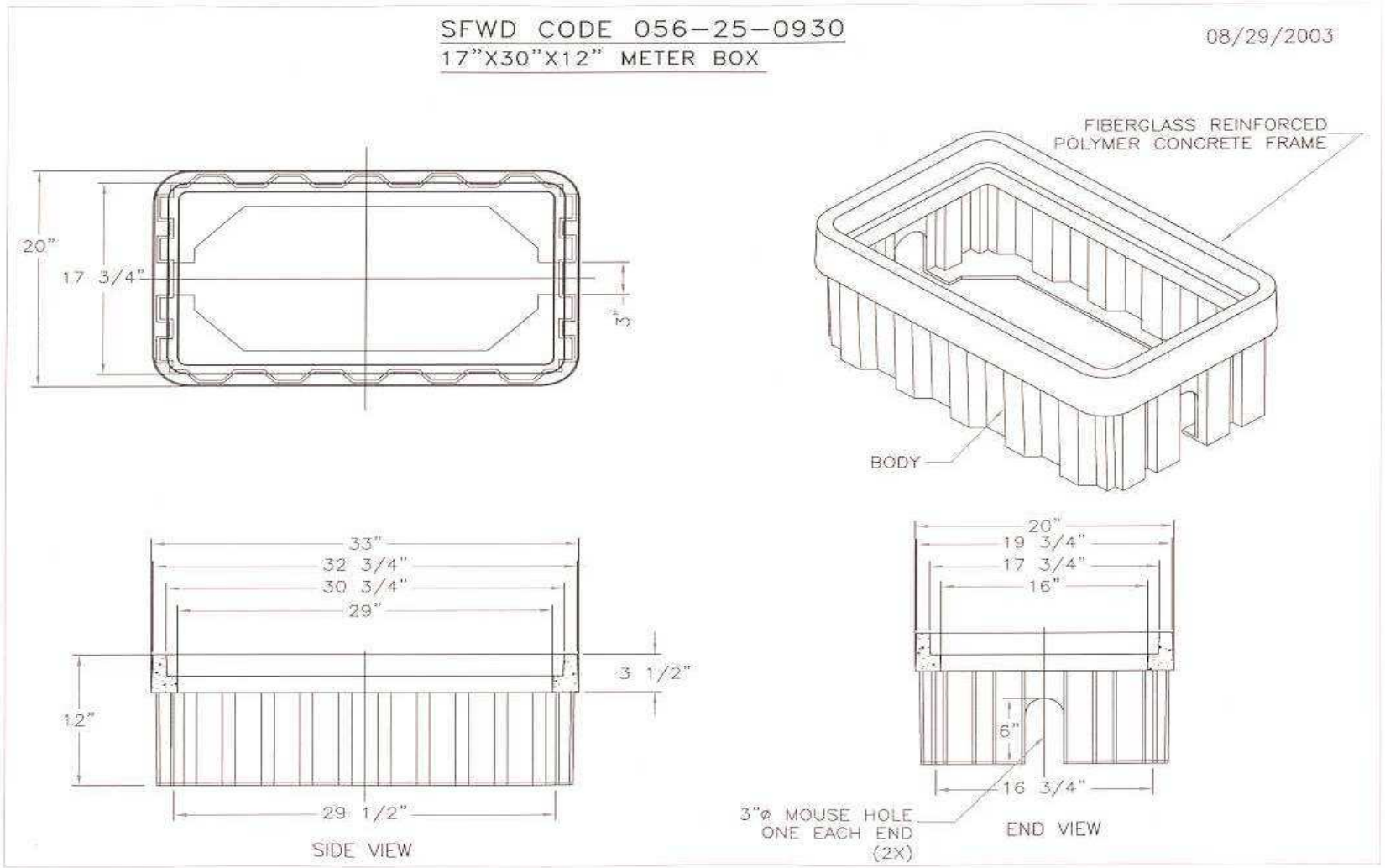
SFWD CODE 056-25-0925

10"X15"X12" METER BOX

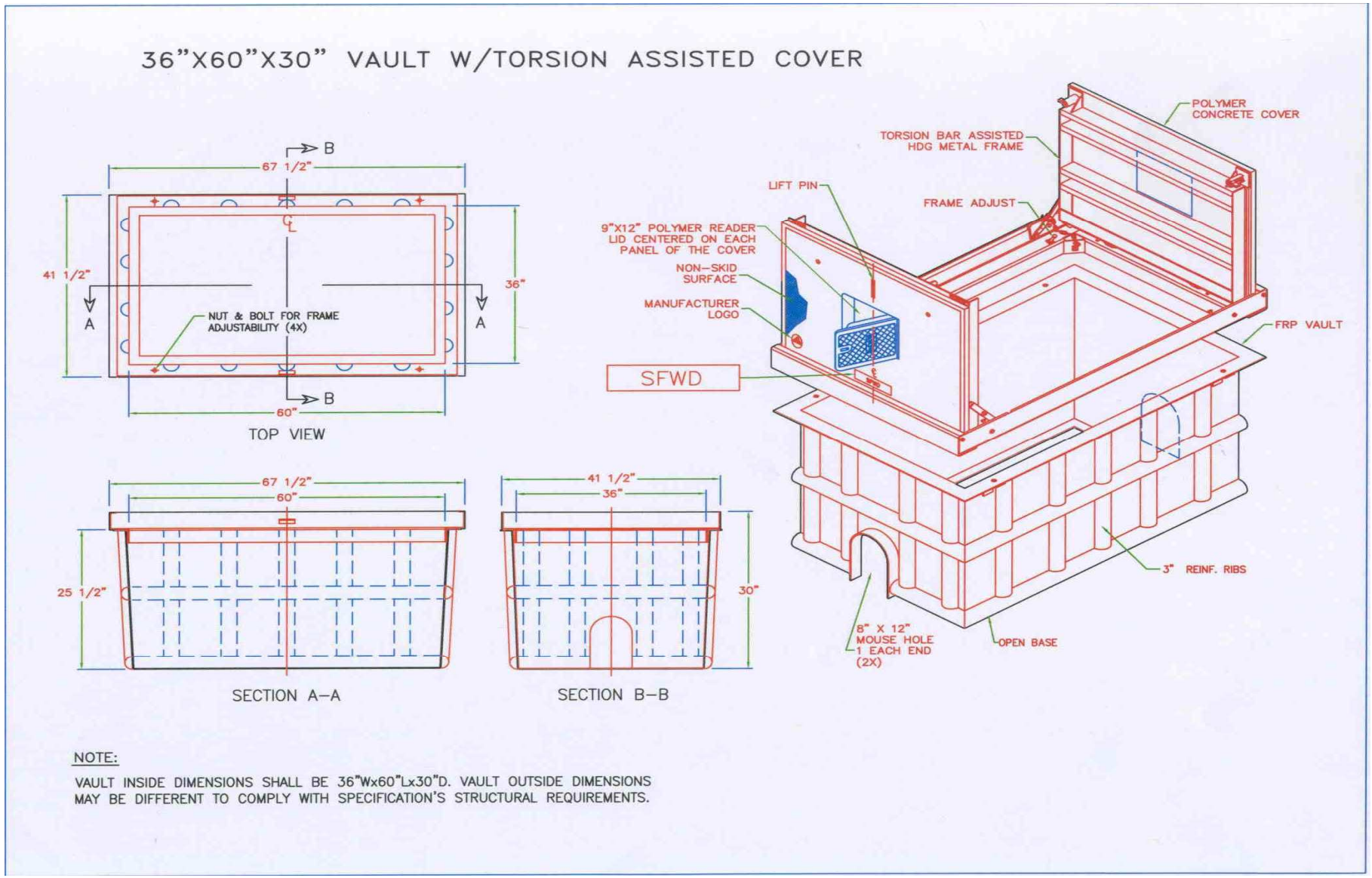
08/29/2003



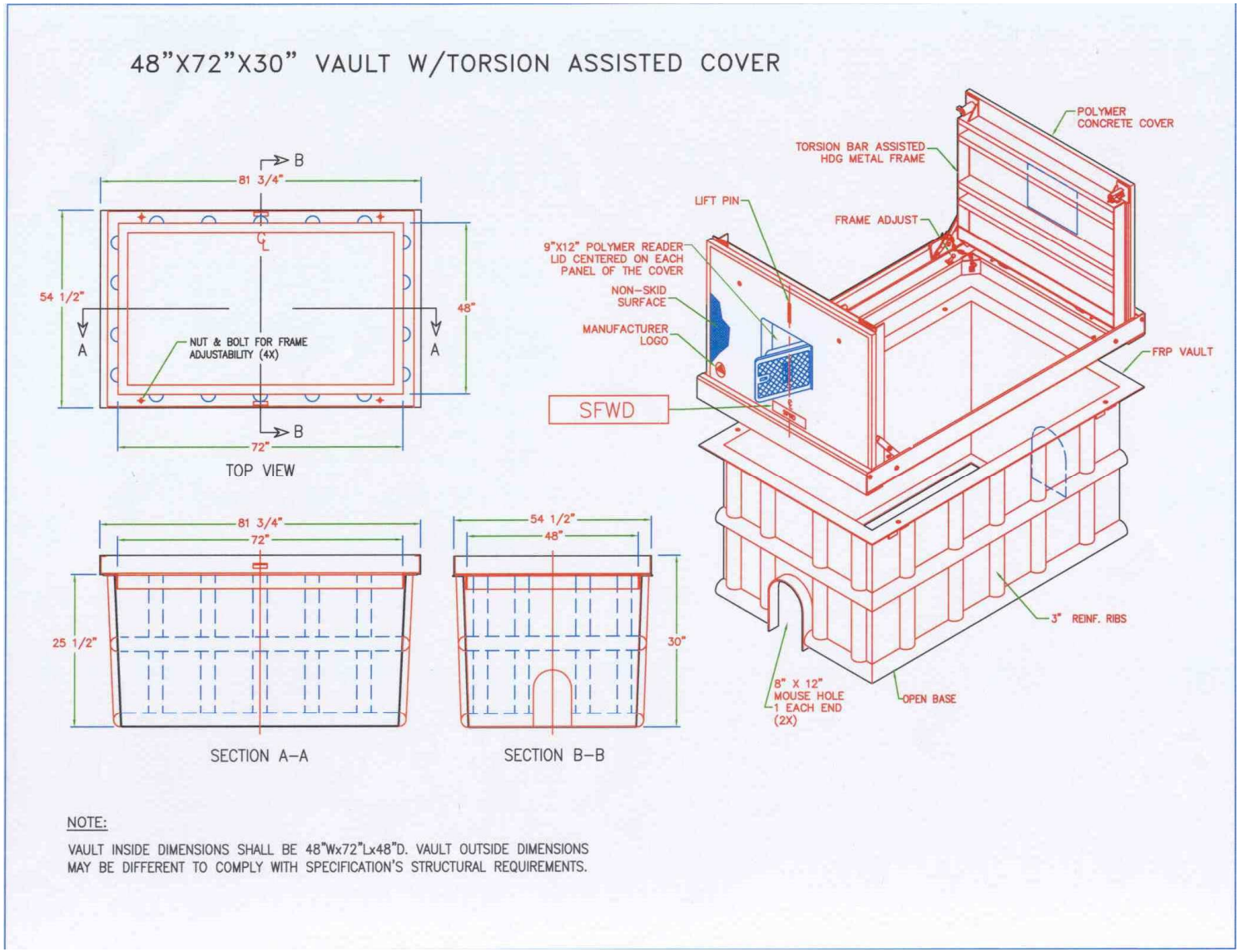
METER BOX FOR 1" METER SERVICE



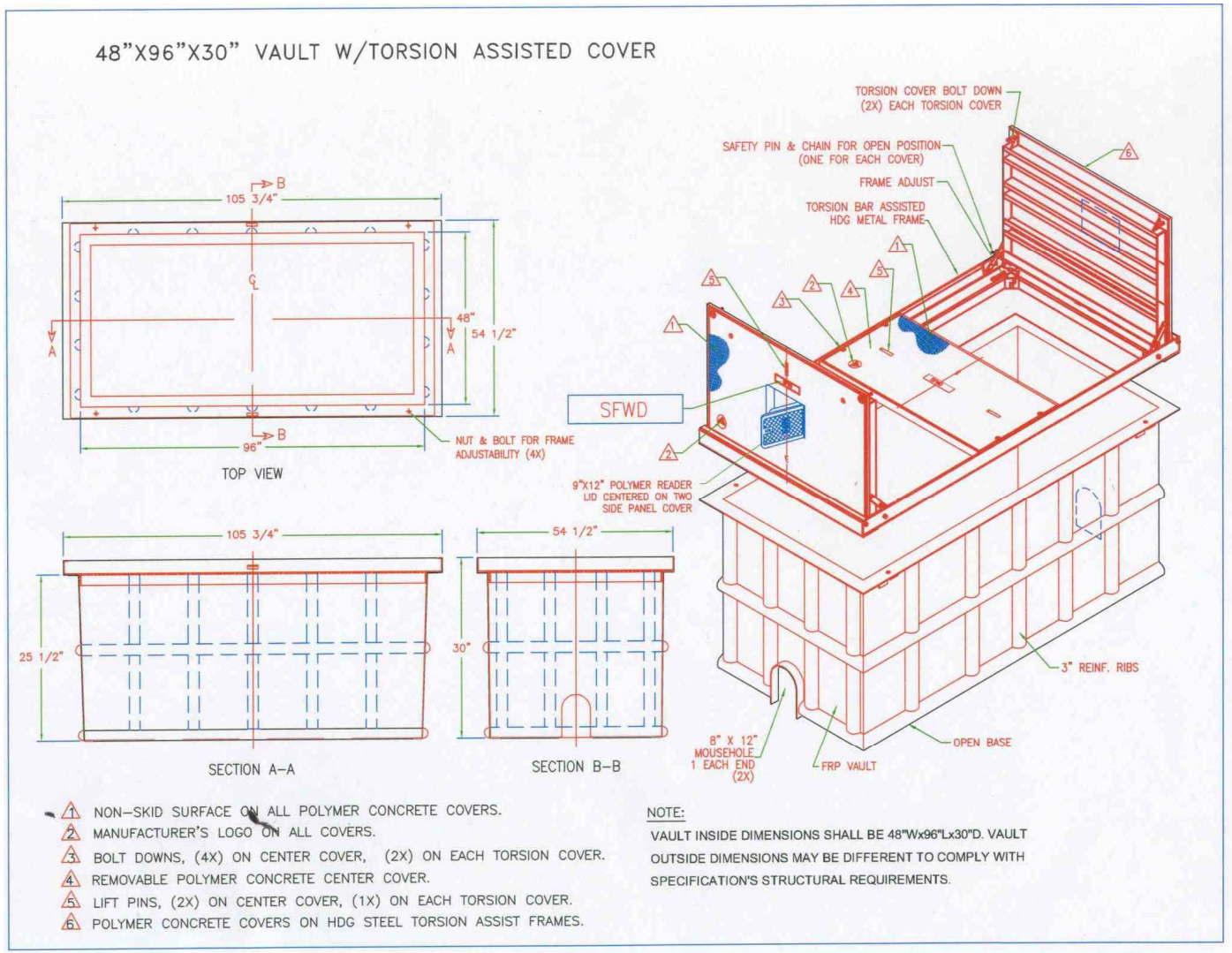
METER BOX FOR 2" METER SERVICE



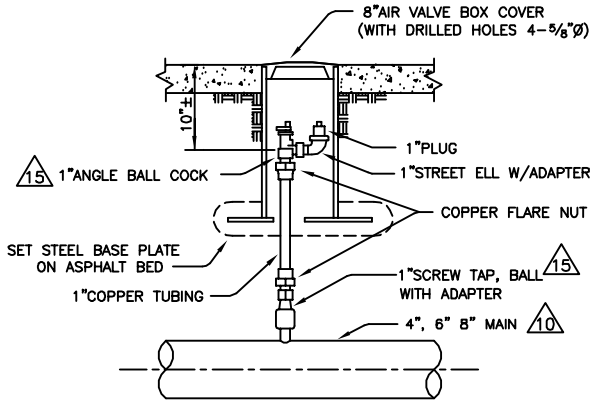
VAULT BOX FOR 4" METER SERVICE



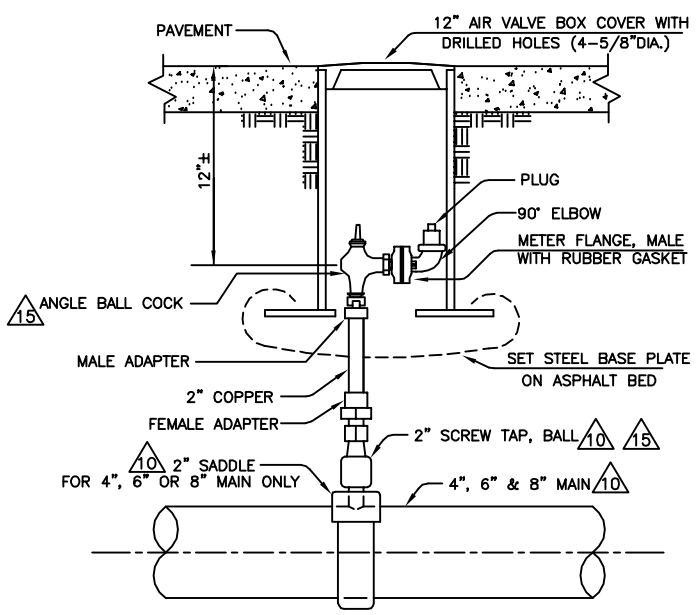
VAULT BOX FOR 6" METER SERVICE


48"X96"X30" VAULT W/TORSION ASSISTED COVER
105 3/4"
B
A
48"
54 1/2"
96"
NUT & BOLT FOR FRAME ADJUSTABILITY (4X)
TOP VIEW
105 3/4"
54 1/2"
25 1/2"
30"
SECTION A–A
SECTION B–B
TORSION COVER BOLT DOWN (2X) EACH TORSION COVER
SAFETY PIN & CHAIN FOR OPEN POSITION (ONE FOR EACH COVER)
FRAME ADJUST
TORSION BAR ASSISTED HDG METAL FRAME
SFWD
9"X12" POLYMER READER LID CENTERED ON TWO SIDE PANEL COVER
3" REINF. RIBS
8" X 12" MOUSEHOLE 1 EACH END (2X)
FRP VAULT
OPEN BASE
1 NON–SKID SURFACE ON ALL POLYMER CONCRETE COVERS.
2 MANUFACTURER'S LOGO ON ALL COVERS.
3 BOLT DOWNS, (4X) ON CENTER COVER, (2X) ON EACH TORSION COVER.
4 REMOVABLE POLYMER CONCRETE CENTER COVER.
5 LIFT PINS, (2X) ON CENTER COVER, (1X) ON EACH TORSION COVER.
6 POLYMER CONCRETE COVERS ON HDG STEEL TORSION ASSIST FRAMES.
NOTE:
VAULT INSIDE DIMENSIONS SHALL BE 48"Wx96"Lx30"D. VAULT OUTSIDE DIMENSIONS MAY BE DIFFERENT TO COMPLY WITH SPECIFICATION'S STRUCTURAL REQUIREMENTS.

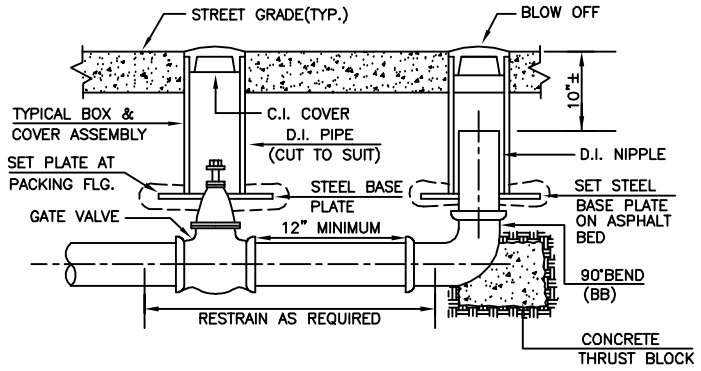
VAULT BOX FOR 8" METER SERVICE


8"AIR VALVE BOX COVER (WITH DRILLED HOLES 4-5/8"Ø)
10"±
1"PLUG
15 1"ANGLE BALL COCK
1"STREET ELL W/ADAPTER
COPPER FLARE NUT
SET STEEL BASE PLATE ON ASPHALT BED
1"COPPER TUBING
1"SCREW TAP, BALL WITH ADAPTER 15
4", 6" 8" MAIN 10

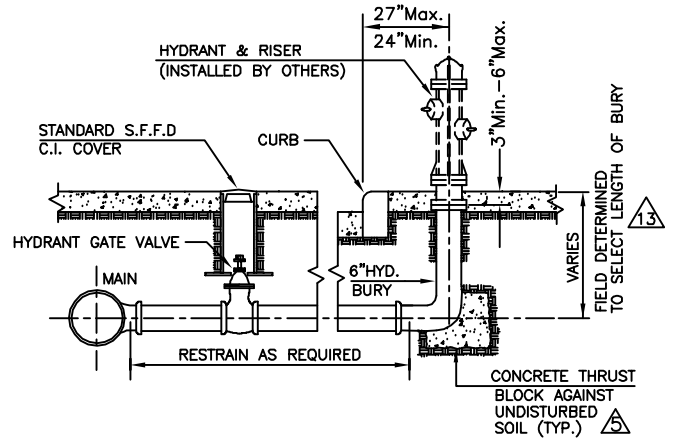
15 4 1" AIR VALVE


PAVEMENT
12" AIR VALVE BOX COVER WITH DRILLED HOLES (4-5/8"DIA.)
12"±
PLUG
90° ELBOW
METER FLANGE, MALE WITH RUBBER GASKET
15 ANGLE BALL COCK
MALE ADAPTER
SET STEEL BASE PLATE ON ASPHALT BED
2" COPPER
FEMALE ADAPTER
2" SCREW TAP, BALL 10 15
10 2" SADDLE FOR 4", 6" OR 8" MAIN ONLY
4", 6" & 8" MAIN 10

4 3 15 2" AIR VALVE & BLOW OFF



4 4", 6" & 8" BLOW OFF



FIRE HYDRANT

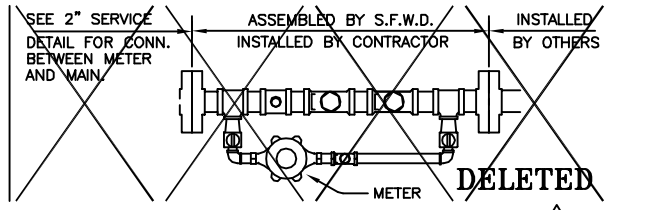
G.V.	BOX
S.C.	6"
4"	6"
6"	6"
8"	8"
12"	8"
16"	8"

B.O.	BOX
2"	12"
4"	6"-6"
6"	6"-8"
8"	8"-12"

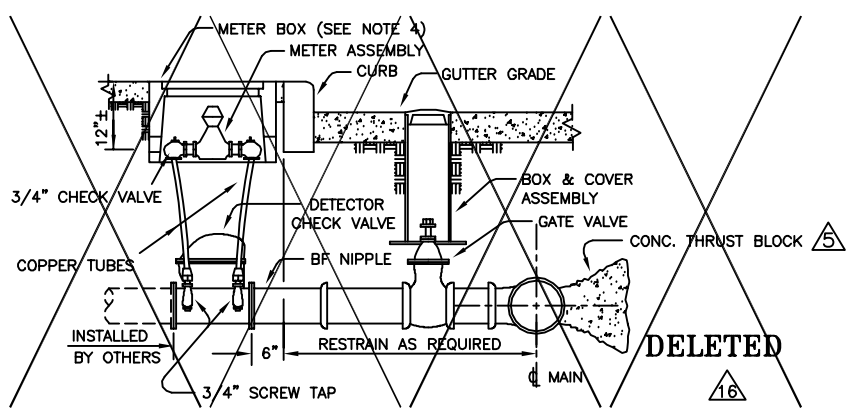
7

NOTE: SEE BLOW OFF DETAILS FOR TYPICAL BOX & COVER ASSEMBLY DETAIL.

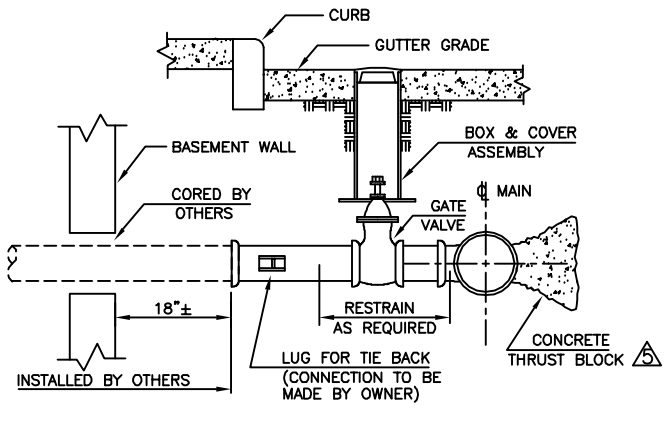
BOX & COVER SIZES



2" FIRE SERVICE



SIDEWALK AREA FIRE SERVICE



BASEMENT AREA FIRE SERVICE

14

GENERAL NOTES:

1. ALL MATERIALS SHOWN ON THE PLANS SHALL BE ASSEMBLED & INSTALLED BY THE CONTRACTOR EXCEPT WHERE NOTED OTHERWISE.
2. ALL FITTINGS 2" OR LESS SHALL BE BRASS UNLESS OTHERWISE SHOWN ON THE PLANS.
3. PLUGS FOR AIR VALVES & BLOW OFF ASSEMBLIES SHALL BE LUBRICATED WITH "NO OXIDE" GREASE & INSTALLED HAND TIGHT.
4. METER BOXES SHALL NOT BE LOCATED IN DRIVEWAYS OR IN SIDEWALK FLAGS THAT CONTAIN OTHER UTILITIES.
5. ALL METER TO BE INSTALLED BY WATER DEPARTMENT EXCEPT WHERE NOTED.
6. TIE NEW ANGLE COCK JUST TO THE RIGHT OF & APPROXIMATELY 1" BELOW EXISTING ANGLE COCK.

NO.	DATE	DESCRIPTION	BY	APPR'D.
1	10-09	Deleted Fire Service	RA	TN
1	8-08	Revised 2" Air Valve and Blow Off	GL	TN
1	8-08	Delete Typical Distribution Manifold; and Joint Restraint Assemblies Detail	GL	TN
1	4-07	Revised Fire Hydrant Details	RA	CY
1	7-03	Removed Service pipe details	RA	TN
1	7-00	Converted to AUTOCAD FILE	RA	RP
1	11-90	Updated 2" Saddle	TC	BD
1	10-89	Updated Tie Rod Size	TC	KW
1	2-89	Updated Restrainer Pipe Size	RA	TSD
1	1-89	Updated Box & Cover Size	TC	TSD
1	11-88	Updated Restrainer Pipe Size	RES	TSD
1	11-86	Conc. thrust block revision	BW	TSD
1	10-84	Additional notes	MR	
1	11-82	Updated service detail	MR	GM
1	10-80	Updated service detail	MR	JK
1	8-76	Added typ. distributor manifold and notes	MR	PM

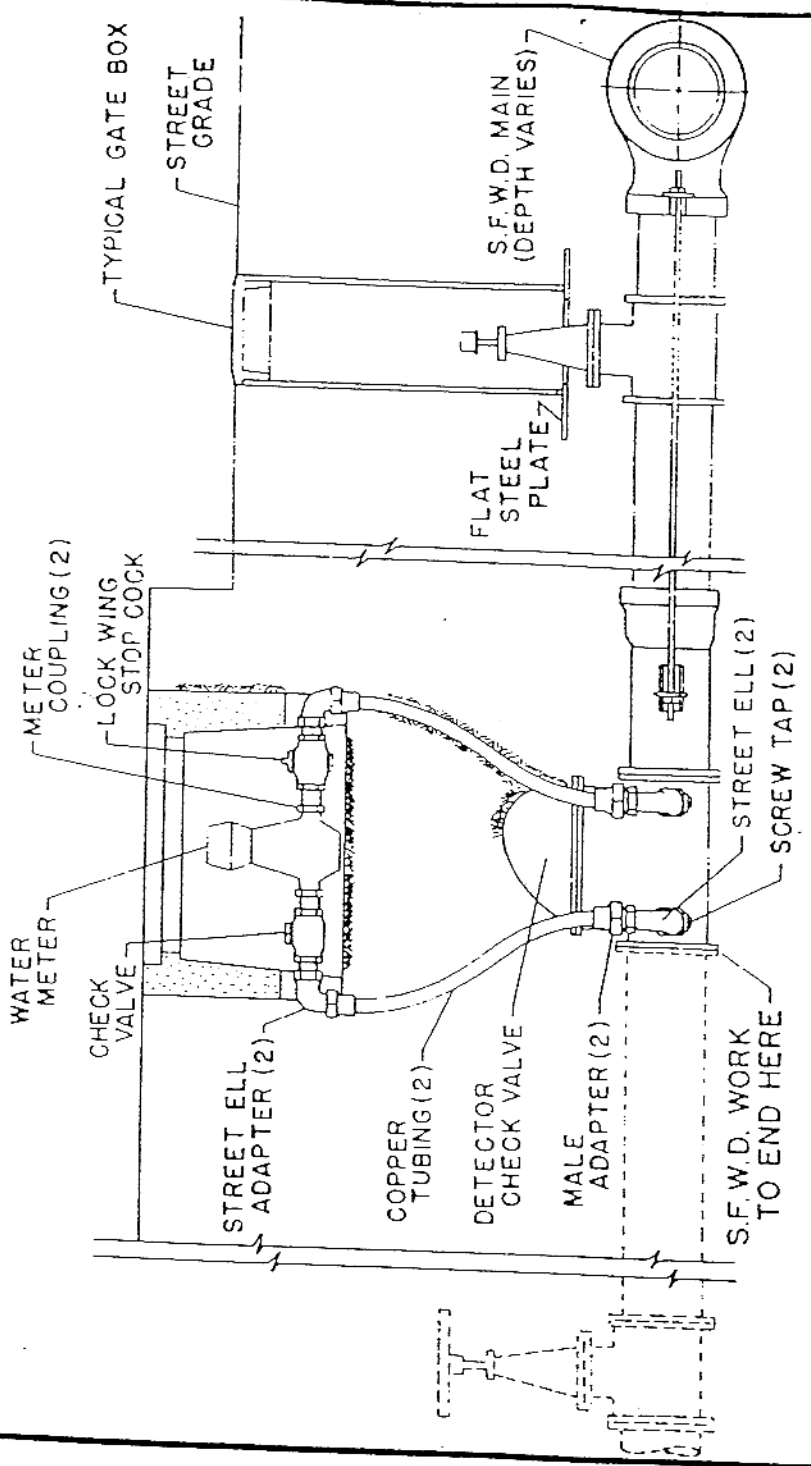
REVISIONS

CAUTION: CHECK WITH TRACING TO SEE IF YOU HAVE LATEST REVISION

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
SAN FRANCISCO WATER DEPARTMENT

STANDARD PLAN FOR DUCTILE IRON PIPE MAIN INSTALLATIONS

RECOMMENDED	BY	DR R.A.	DATE 10/09
APPROVED	REVIEWED	CH.	SCALE N.T.S.
APPROVED			DRAWING NO. E-4969



STANDARD SPECIFICATION FOR SPRINKLER SERVICE CONNECTIONS

ALL SPRINKLER SERVICE CONNECTIONS SHALL BE MADE OF CLASS 150, OR EQUAL, CAST IRON PIPE WITH BELL AND SPIGOT JOINTS. ALL FITTINGS SHALL BE CLASS "D" BELL AND SPIGOT FITTINGS, AND ALL GATES SHALL BE STANDARD S.F. WATER DEPT. GATE VALVES EITHER WITH BELL OR FLANGED ENDS. WHEN IN THE OPINION OF THE WATER DEPT. THE WATER MAY BE SHUT OFF FOR A SUFFICIENT TIME A TEE SHALL BE CUT INTO THE MAIN. IN OTHER CASES AN OPEN SLEEVE SHALL BE USED. THE PIPE SHALL BE BURIED A MINIMUM DEPTH OF 30" TO THE TOP OF THE PIPE, EXCEPT THAT UNDER RAILROAD TRACKS, DUCTILE IRON PIPE BE USED AND A MINIMUM COVER SHALL BE 36". A DETECTOR CHECK VALVE SHALL BE INSTALLED IN ALL SPRINKLER SERVICES, TIE RODS OR LUGS SHALL BE USED TO SECURE PIPE OR GATE VALVES.

NOTE: WORK TO BE DONE BY THE S.F.W.D. SHOWN IN SOLID LINES.
WORK TO BE DONE BY THE OWNER SHOWN IN DASH LINES.

CITY AND COUNTY OF SAN FRANCISCO

PUBLIC UTILITIES COMMISSION

SAN FRANCISCO WATER DEPARTMENT

TYPICAL FIRE SERVICE INSTALLATION SIDEWALK AREA

APPROVED [signature]	RECOMMENDED T. J. Ryan	BY W.J.B	DR. R.E.S	DRAWING NO.
APPROVED [signature] ASSIST. GENERAL MANAGER AND CHIEF ENGINEER		REVIEWED	CH.	A-1234
		DATE AUG-65	REVISED	

TYPICAL GATE BOX
STREET GRADE
FLAT STEEL PLATE
CURB
LUG FOR TIE BACK
JOINT TO BE MADE BY OWNER
S.F.W.D. WORK ENDS HERE
LOCATION OF HOLE IN BASEMENT WALL VARIES DUE TO VARING DEPTHS OF S.F.W.D. MAINS AND OBSTRUCTIONS.
HOLE IN BASEMENT WALL TO BE MADE BY OWNER.
DETECTOR CHECK VALVE AND METER TO BE FURNISHED BY THE S.F.W.D. AND TO BE SET BY THE OWNER.
BY PASS METER

STANDARD SPECIFICATIONS FOR SPRINKLER SERVICE CONNECTIONS

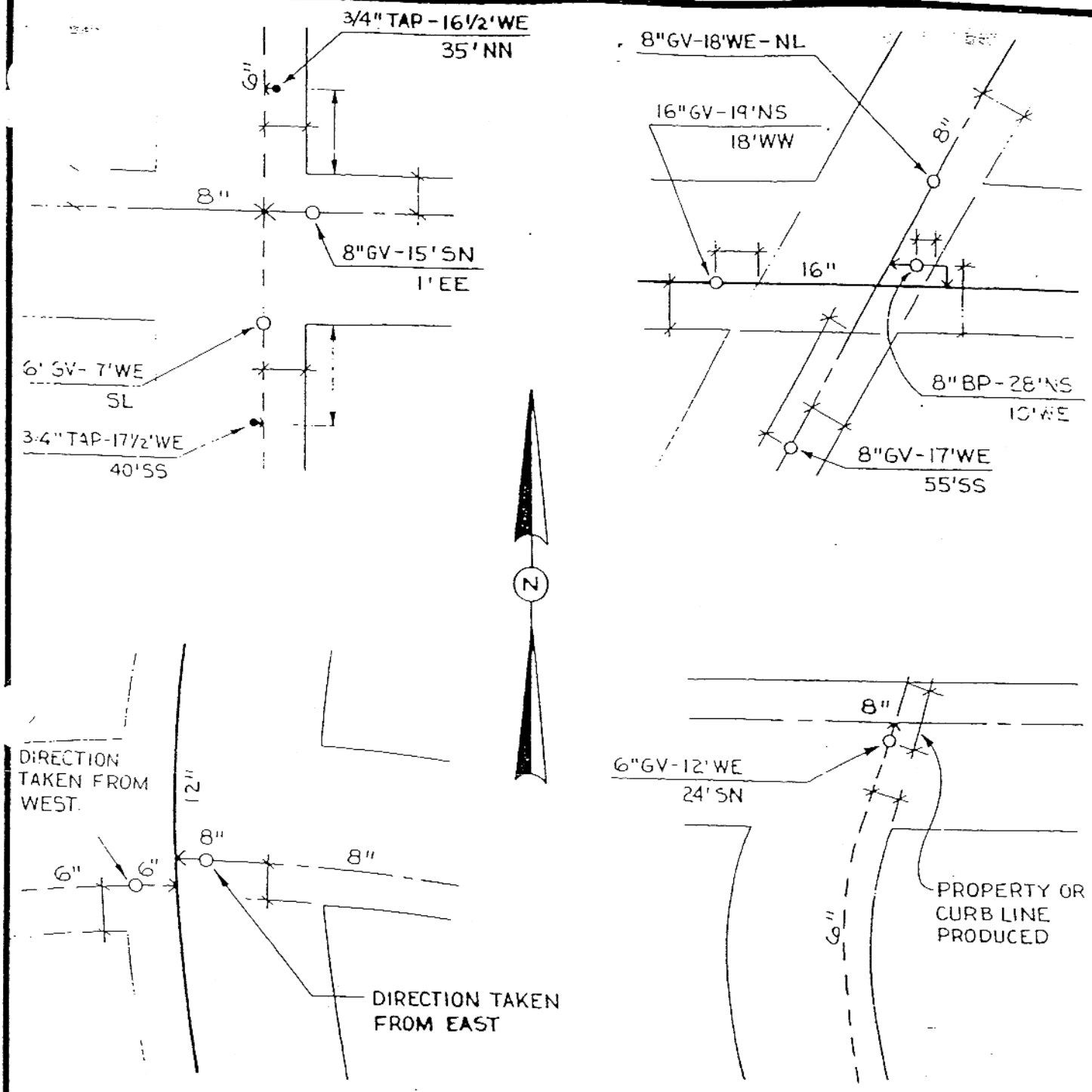
ALL SPRINKLER SERVICE CONNECTIONS SHALL BE MADE OF CLASS 150, OR EQUAL, CAST IRON PIPE WITH BELL AND SPIGOT JOINTS. ALL FITTINGS SHALL BE CLASS "D" BELL AND SPIGOT FITTINGS, AND ALL GATES SHALL BE STANDARD S.F.W.D. GATE VALVES EITHER WITH BELL OR FLANGED ENDS. WHEN IN THE OPINION OF THE WATER DEPT. THE WATER MAY BE SHUT OFF FOR A SUFFICIENT TIME A TEE SHALL BE CUT INTO THE MAIN. IN OTHER CASES AN OPEN SLEEVE SHALL BE USED. ALL BELL AND SPIGOT JOINTS SHALL BE MADE OF LEAD. THE PIPE SHALL BE BURIED A MINIMUM DEPTH OF 30" TO THE TOP OF THE PIPE, EXCEPT THAT UNDER RAILROAD TRACKS, DUCTILE IRON PIPE BE USED AND MINIMUM COVER SHALL BE 36". A DETECTOR CHECK VALVE SHALL BE INSTALLED IN ALL SPRINKLER SERVICES, TIE RODS OR LUGS SHALL BE USED TO SECURE PIPE OR GATE VALVES.

NOTE: WORK TO BE DONE BY THE S.F.W.D. SHOWN IN SOLID LINES.
WORK TO BE DONE BY THE OWNER SHOWN IN DASH LINES.

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
SAN FRANCISCO WATER DEPARTMENT

TYPICAL FIRE SERVICE INSTALLATION BASEMENT AREA

APPROVED [signature] RECOMMENDED [signature]	BY W.B.	DR. R.S.	DRAWING NO.
APPROVED [signature] ASSIST. GENERAL MANAGER AND CHIEF ENGINEER	REVISED	CH.	A-1235
	DATE SEPT. 25	REVISED	

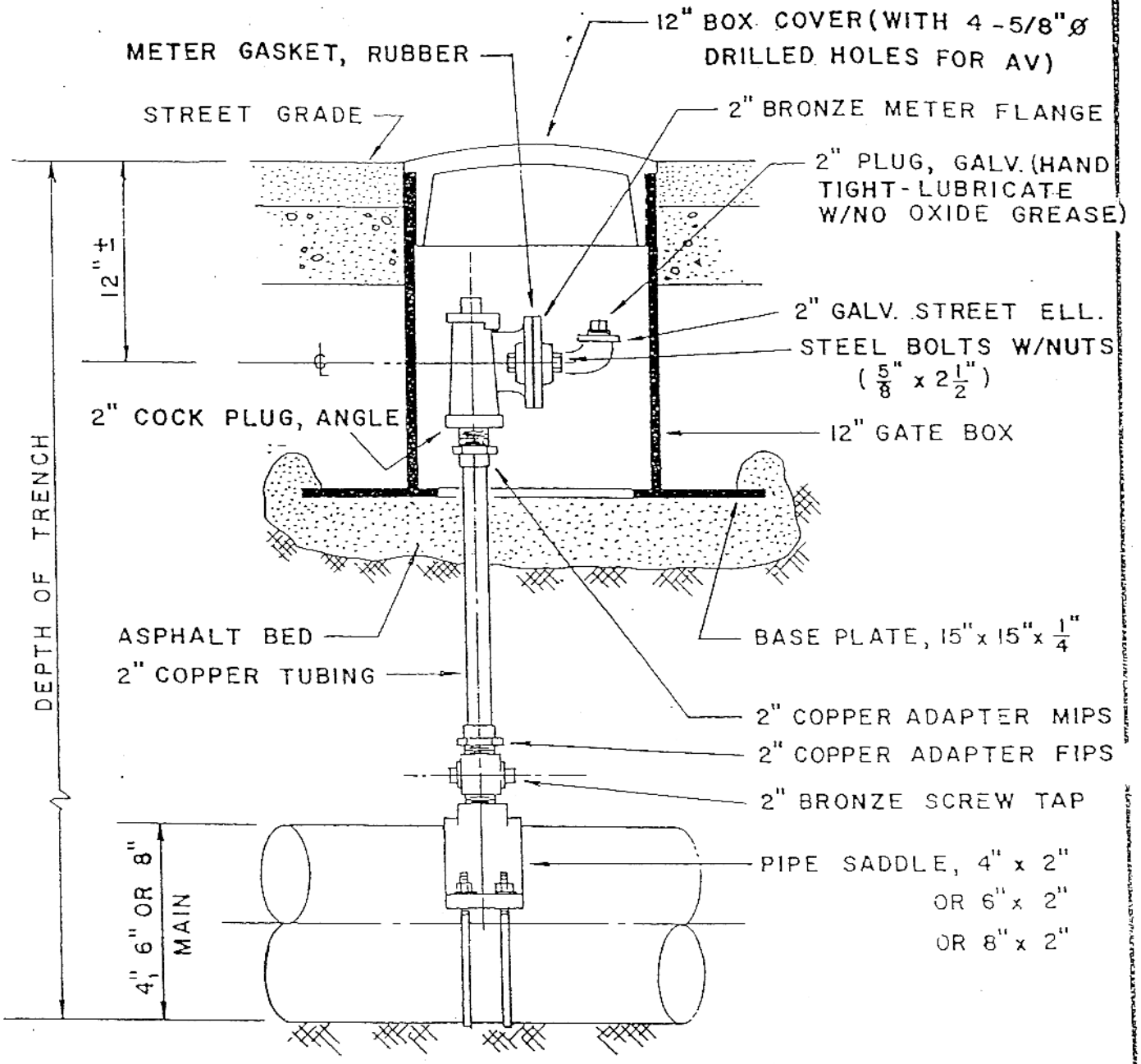


CITY AND COUNTY OF SAN FRANCISCO

PUBLIC UTILITIES COMMISSION
SAN FRANCISCO WATER DEPARTMENT

TYPICAL METHOD OF MEASURING RECORDING AND IDENTIFYING MAINS SERVICES, GATE VALVES AND ALL APPURTENANCES

APPROVED	SCALE 1" = 60'-0"	BY G.Y.N.	DR. J.S.	DRAWING NO.
APPROVED		TR.	CH. R.B.	A-1247
GENERAL MANAGER AND CHIEF ENGINEER		DATE 10-24-66	REVISED 10-5-71	


12" BOX COVER (WITH 4 - 5/8" ø DRILLED HOLES FOR AV)
METER GASKET, RUBBER
STREET GRADE
2" BRONZE METER FLANGE
2" PLUG, GALV. (HAND TIGHT - LUBRICATE W/NO OXIDE GREASE)
12" ±
2" GALV. STREET ELL.
STEEL BOLTS W/NUTS (5/8" x 2 1/2")
2" COCK PLUG, ANGLE
12" GATE BOX
DEPTH OF TRENCH
ASPHALT BED
BASE PLATE, 15" x 15" x 1/4"
2" COPPER TUBING
2" COPPER ADAPTER MIPS
2" COPPER ADAPTER FIPS
2" BRONZE SCREW TAP
PIPE SADDLE, 4" x 2"
OR 6" x 2"
OR 8" x 2"
4", 6" OR 8"
MAIN

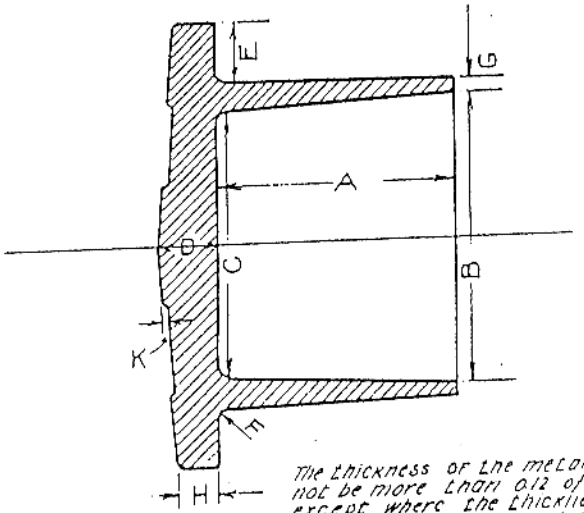
CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
SAN FRANCISCO WATER DEPARTMENT

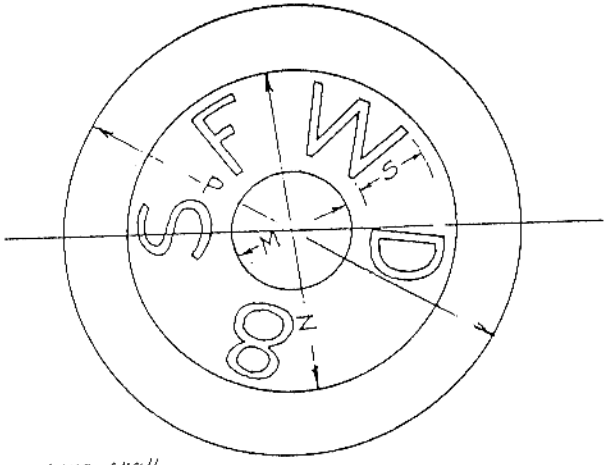
TYPICAL 2" AIR VALVE OR BLOW OFF INSTALLATION

APPROVED MHL	SCALE NTS	BY B. DESAL	DR. RBA	DRAWING NO. A-1281
APPROVED for Martin M. Bierbaum GENERAL MANAGER AND CHIEF ENGINEER		REVIEWED TSD	CH.	supercedes A-1230
		DATE 8-21-89	REVISED	

All cast iron shall be strong, tough, of even grain, and sufficiently soft to permit easy machinning.

All cast iron used for manufacturing of cast iron pipe fittings shall conform to the grade known as "Class A" as specified in the Standard Specifications for Gray-Iron Castings for Valves, Flanges, and Pipe Fittings, Designation A 126-30, dated 1930 of the American Society for Testing Materials.





SIZE	MAX WT
4	9
6	14
8	26
12	62

Weight in Pounds

The thickness of the metall in the body of the casting shall not be more than 0.12 of an inch less than that specified except where the thickness is 1 inch or more, the variation shall not exceed 0.15 of an inch.

No casting shall be accepted, the weight of which is more than ten (10) per cent less than that specified.

When ten (10) or more castings off the same pattern are ordered the weight to be paid for shall not be more than six(6) per cent in excess of the specified weight.

When less than ten (10) castings off the same pattern are ordered the weight that shall be paid for, shall not be more than ten (10) per cent in excess of the specified weight.

SIZE	A	B	C	D	E	F	G	H	K	M	N	P	S
4	3½	3	2¾	1	1	¼	¼	½	⅛	2	4	5½	1
6	3½	5	4½	1	1	¼	¼	⅝	⅛	2	4½	7½	1¼
8	3½	6½	6	1⅛	1	¼	⅜	¾	⅛	2	6½	9½	1¼
12	3½	11	10⅛	1¼	1⅛	¼	⅜	⅞	⅛	2	10½	14	1½

NOTE- All Dimensions are in inches

APPROVED BY

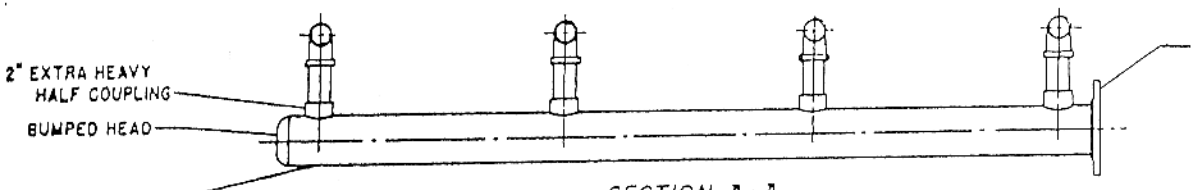
STANDARD GATE COVER

SAN FRANCISCO WATER DEPT.
CITY DISTRIBUTING SYSTEM

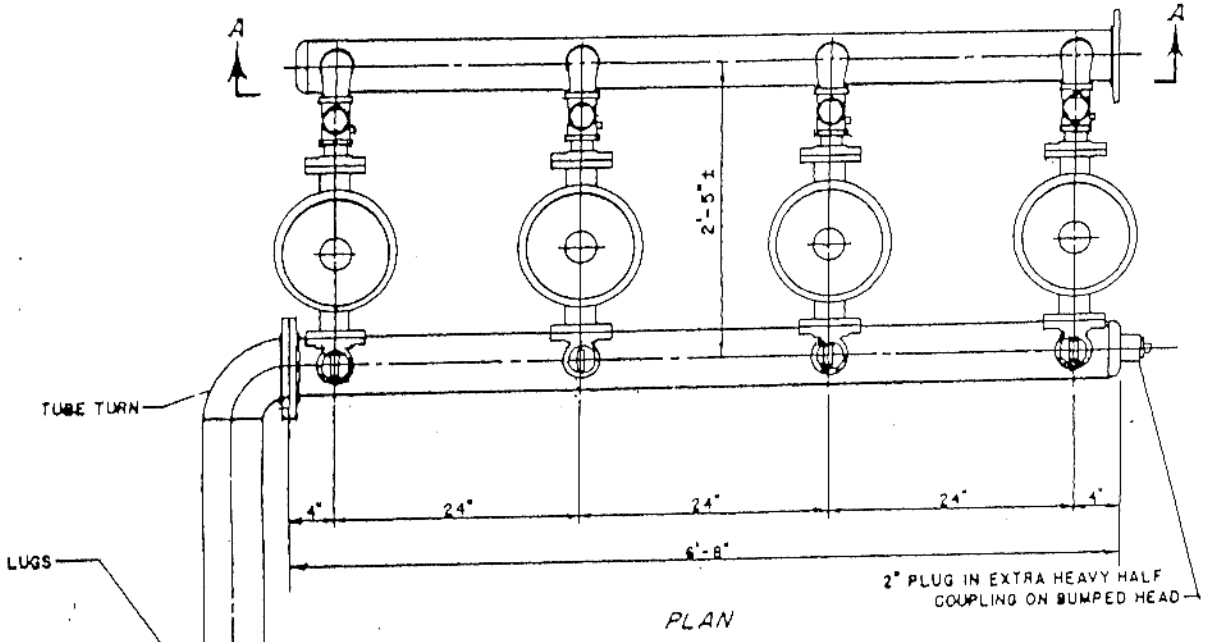
By. O. G. Goldman
Traced By.
Checked "
Date: Nov-1924.
No Scale.

Supersedes-
Superseded By-

C-377



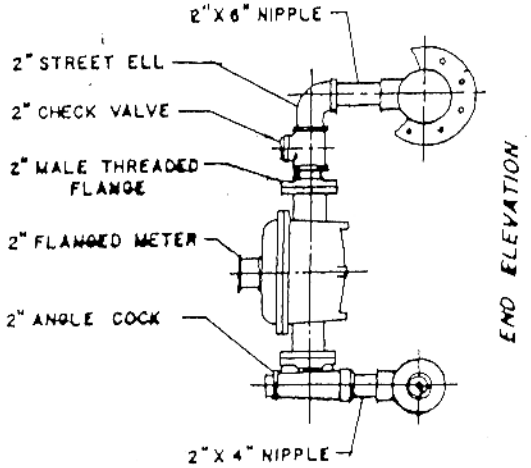
SECTION A-A



PLAN

NOTE: PIPE SIZE AND METERS REQUIRED

3" PIPE - 2 - 2" METERS
4" PIPE - 4 - 2" METERS
6" PIPE - 6 - 2" METERS
8" PIPE - 8 - 2" METERS



END ELEVATION

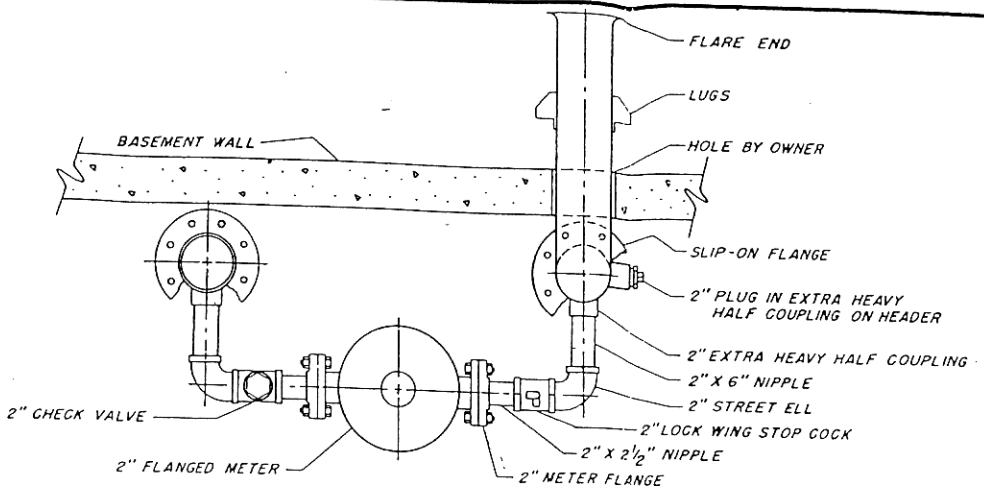
NO.	DATE	DESCRIPTION	BY	APPD.
2	Nov 79	C-928R-Supercedes C-928	RES	
1	Oct 65	C-928 Supercedes C-404	RES	WJB

REVISIONS
CAUTION: CHECK WITH TRACING TO SEE IF YOU HAVE LATEST REVISION

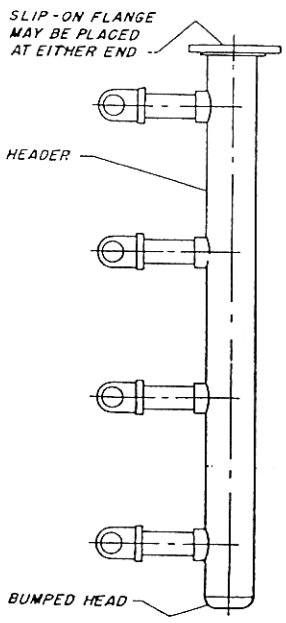
CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
SAN FRANCISCO WATER DEPARTMENT

TYPICAL DISTRIBUTOR MANIFOLD SIDEWALK INSTALLATION

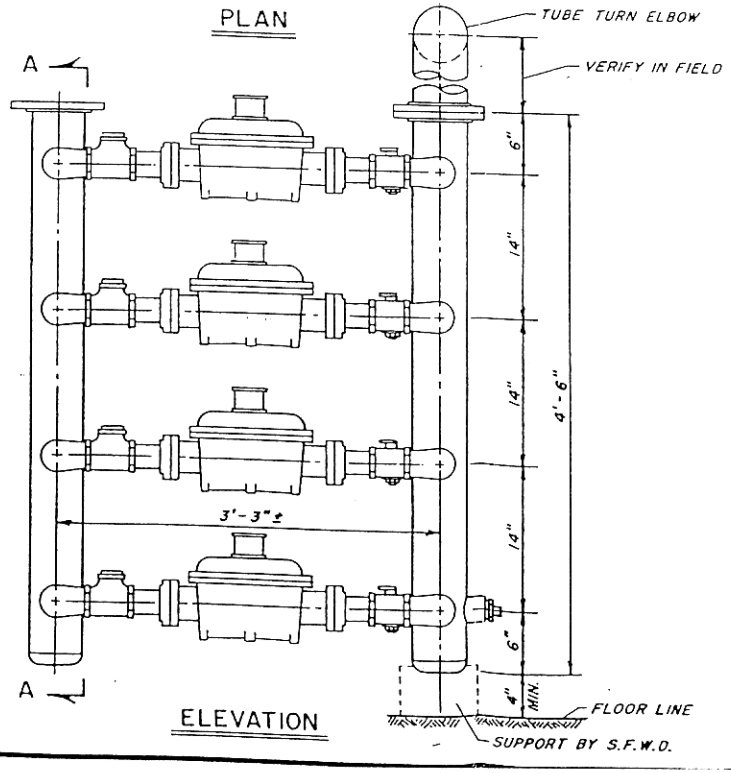
BY W.J.B.	DR R.E.S.	DATE OCT-65
CHKD	CH.	SCALE NONE
APPROVED: H.C. Mel Lunge ASSISTANT GENERAL MANAGER AND CHIEF ENGINEER		DRAWING NO. C-928R



PLAN



SECTION A-A



ELEVATION

NOTE: PIPE SIZE AND METERS REQUIRED

3" PIPE - 2 - 2" METERS
4" PIPE - 4 - 2" METERS
6" PIPE - 6 - 2" METERS
8" PIPE - 8 - 2" METERS

NO.	DATE	DESCRIPTION	BY	APP'D.

REVISIONS
CAUTION: CHECK WITH TRACING TO SEE IF YOU HAVE LATEST REVISION

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
SAN FRANCISCO WATER DEPARTMENT

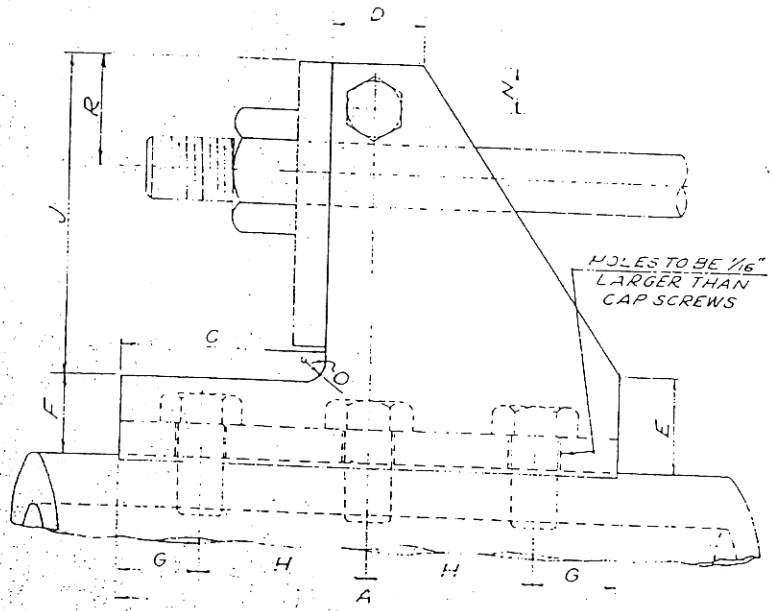
TYPICAL DISTRIBUTOR MANIFOLD BASEMENT INSTALLATION

RECOMMENDED [signature]	BY G.Y.N.	DR. R.E.S.	DATE APRIL 28 - 67
APPROVED [signature]	REVIEWED [signature]	CH. M.H.K.	SCALE NONE
APPROVED [signature] ASSISTANT GENERAL MANAGER AND ASSISTANT CHIEF ENGINEER			DRAWING NO. C-948

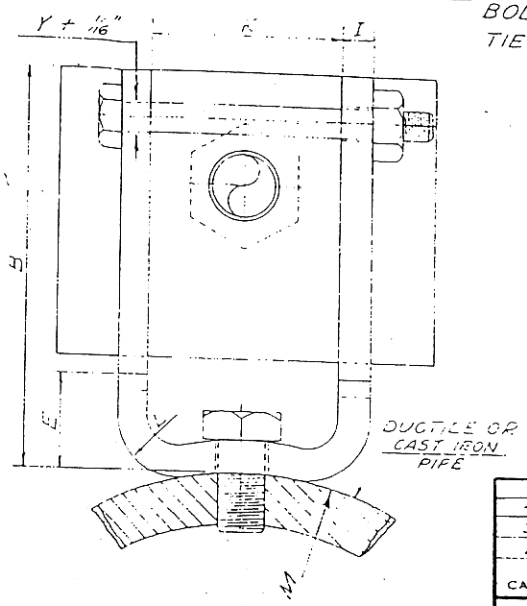
SIZE	LUG												WASHER						CAP SCREW	TIE ROD			LOCK BOLT	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
4	4	3 1/4	1 5/8	3/4	3/4	5/8	5/8	1 3/8	1/4	2 5/8	1 1/4	1/2	2.40	5/16	5/32	2 1/2	3	1 3/16	1 1/16	1/4	3/8	3/4	5/8	V	1/4	2 1/2
6	5	3 5/8	2 1/4	1	1	7/8	7/16	2 1/16	1/4	2 3/4	1 1/2	1/2	3.45	7/16	5/32	2 1/2	3	1 3/16	1 1/16	1/4	3/8	1	5/8	A	5/16	3
8	6	4 1/8	2 3/8	1 1/2	1	3/4	5/8	2 3/8	1/4	3 3/8	1 3/4	1/2	4.53	1/2	5/32	3 1/2	3 3/4	1 1/2	1 3/16	3/8	1/2	1	3/4	R	1/2	3 1/2
12	8	5 7/8	3 1/8	1 1/2	1 1/4	1 3/8	15/16	3 1/16	3/8	4 1/2	3	1	6.60	13/16	11/32	3 1/2	4 3/4	1 1/2	1 1/16	1/2	5/8	1 1/2	1	I	3/4	5
16	8	5 7/8	3 1/8	1 1/2	1 1/4	1 3/8	15/16	3 1/16	3/8	4 1/2	3	1	8.70	13/16	11/32	4	4 3/4	1 5/8	1 5/16	3/4	5/8	1 1/2	1 1/4	E	3/4	5
																								S		

NOTE: ALL DIMENSIONS ARE IN INCHES.

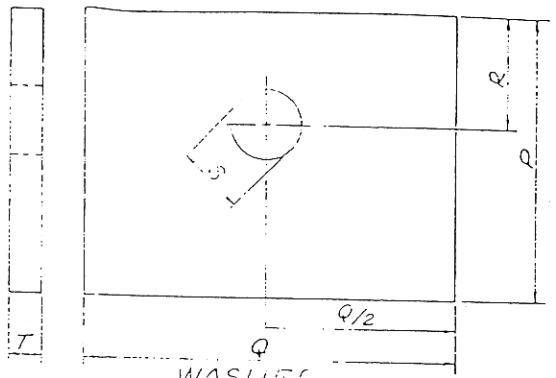
MATERIAL: STEEL PLATES: ASTM A-283, GRADE B
BOLTS AND TIE RODS: ASTM A-307, GRADE B
TIE ROD THREADS TO BE CUT OR ROLLED.



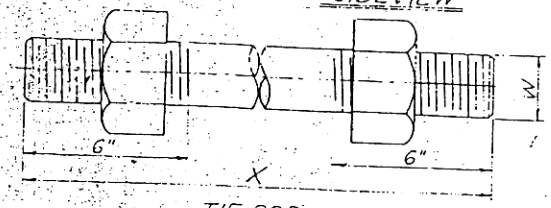
LUG SIDEVIEW



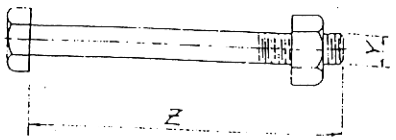
LUG FRONT VIEW



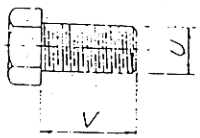
WASHER



TIE ROD



LOCK BOLT



CAP SCREW

NOTE: BOLT HEAD AND NUT TO BE HEXAGON HEAVY SERIES

5	8/15/79	REVISED LEGEND	RES	JDC
4	1/4/76	MATERIAL SPEC.	RES	GYN
3	8/4/14	DIMENSIONS	RES	GYN
2	12/8/71	REDRAWN	RES	GYN

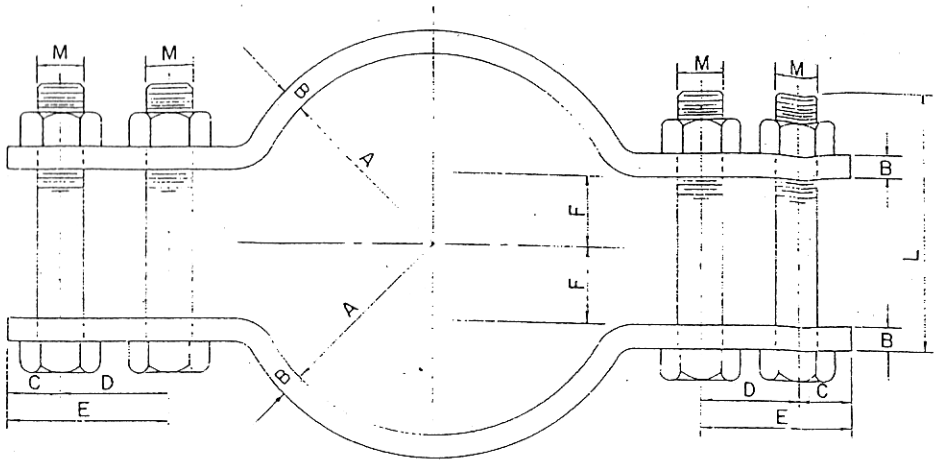
REVISIONS

CAUTION: CHECK WITH TRACING TO SEE IF YOU HAVE LATEST REVISION

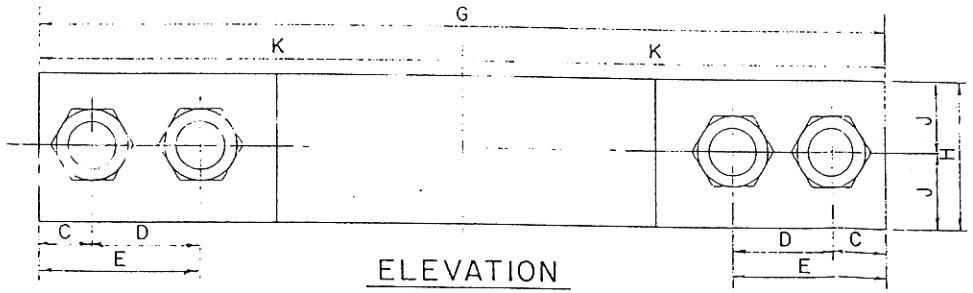
CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
SAN FRANCISCO WATER DEPARTMENT

LUG AND TIE ROD

RECOMMENDED	BY GYN	DR. RES	DATE DEC. 8-71
APPROVED	REVISED	CH. RKB	SCALE NONE
APPROVED	ASSISTANT GENERAL MANAGER AND CHIEF ENGINEER		DRAWING NO. C-964



PLAN



ELEVATION

GENERAL NOTES

1. MATERIALS:
   Steel Band - ASTM A 283 grade B.
   Bolts - ASTM A 307 grade B.
2. Bolt heads and nuts to be hexagon heavy series.
   Thread length shall equal L/2
3. Bolt holes:
   a. 1/8" larger than bolts.
   b. Holes may be drilled or punched.

THIS DRAWING SUPERSEDES C-528-R54

NO.	DATE	DESCRIPTION	BY	APPR'D
7	4-81	Revision to L Dimensions	MR	
6	1-80	Revised	RS	
5	4-78	Redrawn	MR	
4	2-76	Redrawn	RS	

REVISIONS
CAUTION: CHECK WITH TRACING TO SEE IF YOU HAVE LATEST REVISION

CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
SAN FRANCISCO WATER DEPARTMENT

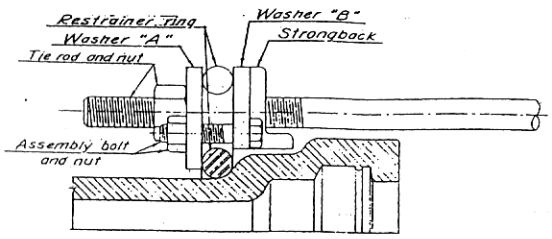
PLAIN & BELL BANDS

RECOMMENDED
APPROVED
BY JDC
DR M.R.
CH
REVIEWED
DATE 4-3-78
SCALE None
APPROVED Eugene Kelleher
GENERAL MANAGER & CHIEF ENGINEER
DRAWING NO. C-1081

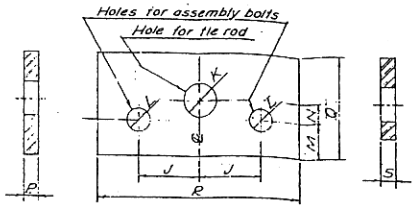
STEEL BAND DIMENSIONS (DIMENSIONS IN INCHES)

SIZE OF BAND BELL	SIZE OF BAND PLAIN	A	B	C	D	E	F	G	H	J	K	L	M
	2	1 5/16	3/8	1 1/8	1 3/4	2 7/8	3/4	10 5/8	2	1	5 5/16	5	5/8
2	3	2	3/8	1 1/8	1 3/4	2 7/8	7/8	11 3/4	2	1	5 7/8	5	5/8
3	4	2 1/2	3/8	1 1/8	1 3/4	2 7/8	1	12 5/8	2	1	6 5/16	5	5/8
4	6	3 1/2	3/8	1 1/8	1 3/4	2 7/8	1	14 3/4	2	1	7 3/8	5	5/8
6	8	4 5/8	3/8	1 1/8	1 3/4	2 7/8	1	18	2	1	9	5	5/8
8	10	5 3/4	3/8	1 1/8	1 3/4	2 7/8	1	20	2	1	10	5	5/8
10	12	6 3/4	1/2	1 3/8	2 3/8	3 3/4	1 1/4	23 1/4	2 1/2	1 1/4	11 5/8	5	3/4
12	14	8 1/16	5/8	1 3/8	2 3/8	3 3/4	1 1/4	27 3/8	2 1/2	1 1/4	13 5/8	5	3/4
14	16	8 7/8	5/8	1 1/2	2 3/8	3 7/8	1 1/4	28 1/4	2 1/2	1 1/4	14 1/8	5	3/4
16	18	10	5/8	1 1/2	2 1/2	4	1 1/4	30 5/8	2 1/2	1 1/4	15 5/16	5	3/4

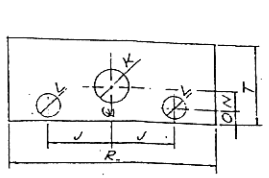
W. D. SPECIFICATION NO.



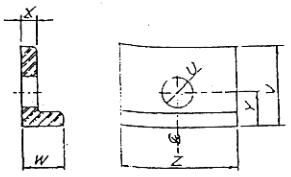
WASHER ASSEMBLY ON RUBBER GASKET JOINT BELL



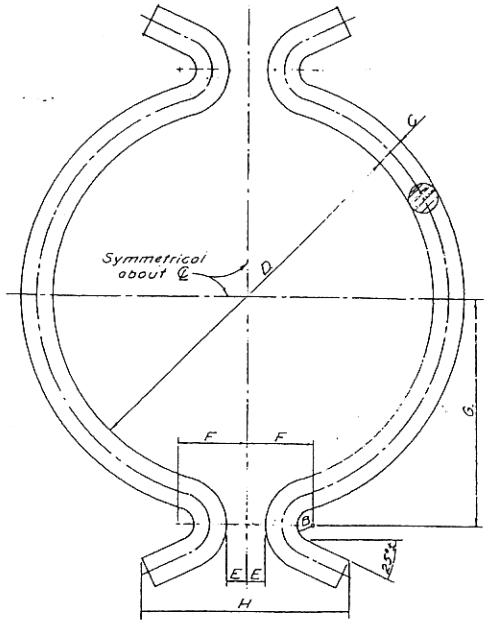
WASHER "A"



WASHER "B"



STRONGBACK



RESTRAINER RING

SIZE	RESTRAINING RING							WASHERS											STRONGBACK					
	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
4	3/8	3/4	5	1/2	1 5/8	3 3/8	5±	1 1/2	1 1/16	9/16	7/8	1/2	3/8	3/8	2 1/2	5	3/8	2						
6	3/8	3/4	7 1/4	1/2	1 5/8	4 1/2	5±	1 1/2	1 1/16	9/16	7/8	1/2	3/8	3/8	2 1/2	5	3/8	2						
8	3/8	3/4	9 5/16	1/2	1 5/8	5 9/16	5±	1 1/2	1 5/16	9/16	7/8	1/2	1/8	3/8	2 1/2	5	3/8	2	3/4	2	1	3/8	7/8	2 5/16
12	7/16	1 1/4	13 5/8	1 1/16	2 3/8	8 3/16	8 3/16±	2 1/8	1 1/16	1 1/16	1 3/8	7/16	3/4	3/4	3 1/2	8	3/8	3	1	2	1 3/16	3/8	1 1/4	3 3/8
16																								

NOTE: ALL DIMENSIONS ARE IN INCHES.

SIZE	RING AND WASHER ASSEMBLY
4	9 LBS.
6	10 LBS.
8	12 LBS. *
12	38 LBS. *
16	

* INCLUDES STRONGBACK

NOTE:

1. One assembly to consist of
   1 - Restrainer ring (2-Halves)
   2 - Washer "A"
   2 - Washer "B"
   2 - Strongback for 8" and larger pipes.
   4 - Assembly bolts and nuts
2. Following to be furnished from warehouse.
   a. Tie rods and nuts
   b. Assembly bolts and nuts

NO.	DATE	DESCRIPTION	BY	APP'D

REVISIONS
CAUTION: CHECK WITH TRACING TO SEE IF YOU HAVE LATEST REVISION

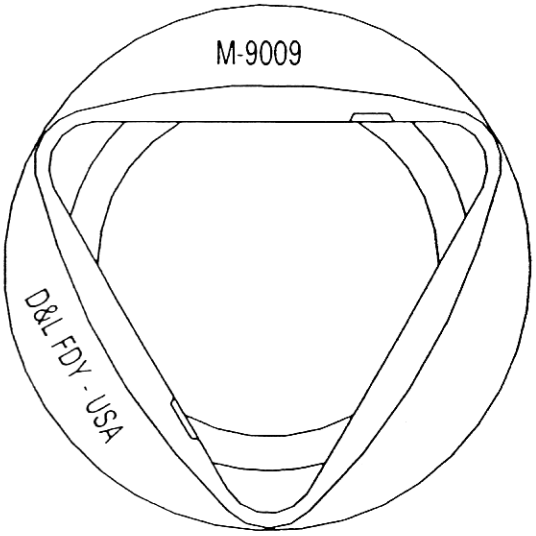
CITY AND COUNTY OF SAN FRANCISCO
PUBLIC UTILITIES COMMISSION
SAN FRANCISCO WATER DEPARTMENT

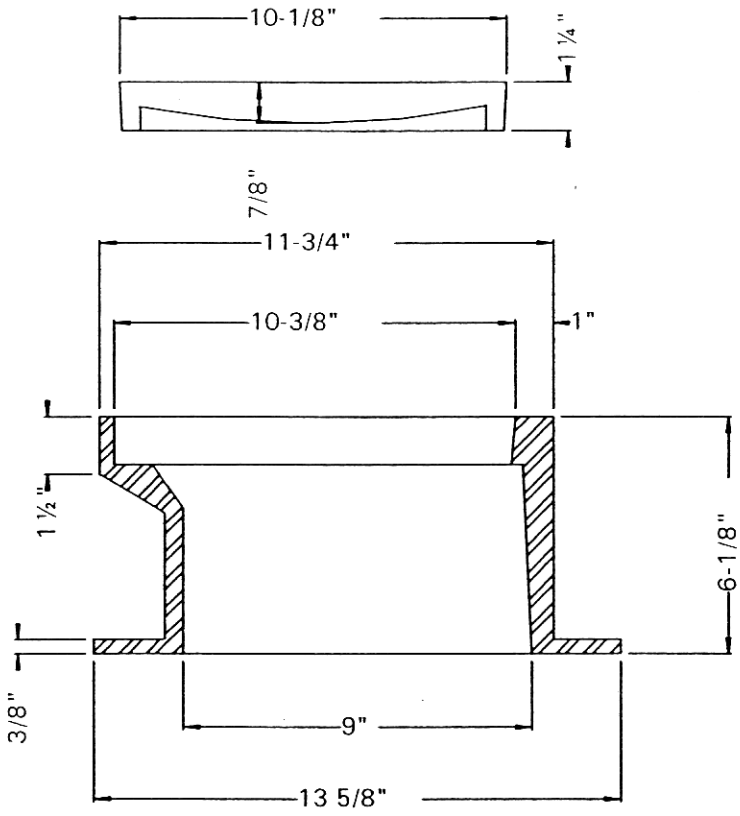
RESTRAINING RING AND WASHER ASSEMBLY ON RUBBER GASKET JOINT BELL

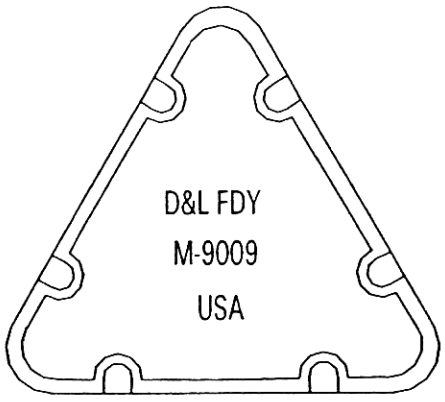
	BY	DR	DATE
RECOMMENDED	GYN	RES	JULY 20-73
APPROVED	CH.	RKB	SCALE NONE
APPROVED			DRAWING NO. D-1501

M-9009

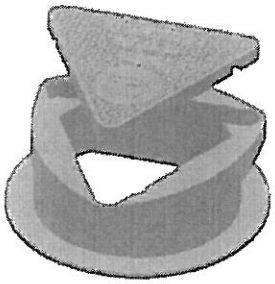
SFWD Triangle Valve Box Ring & Cover

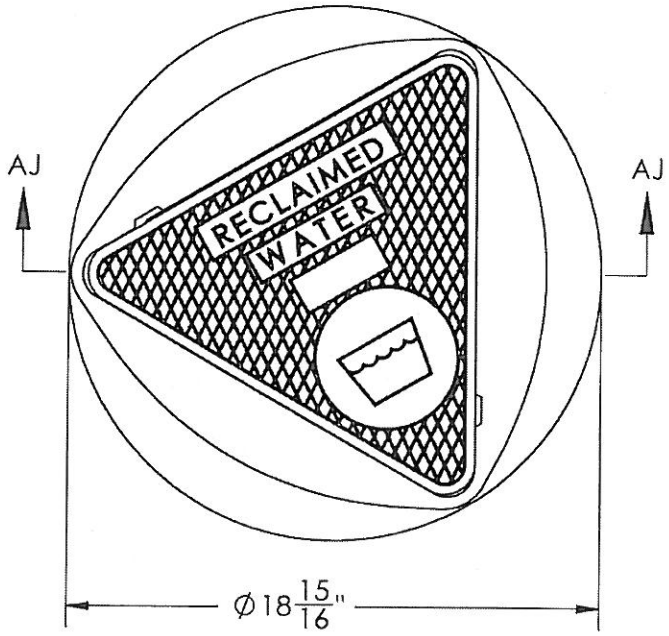


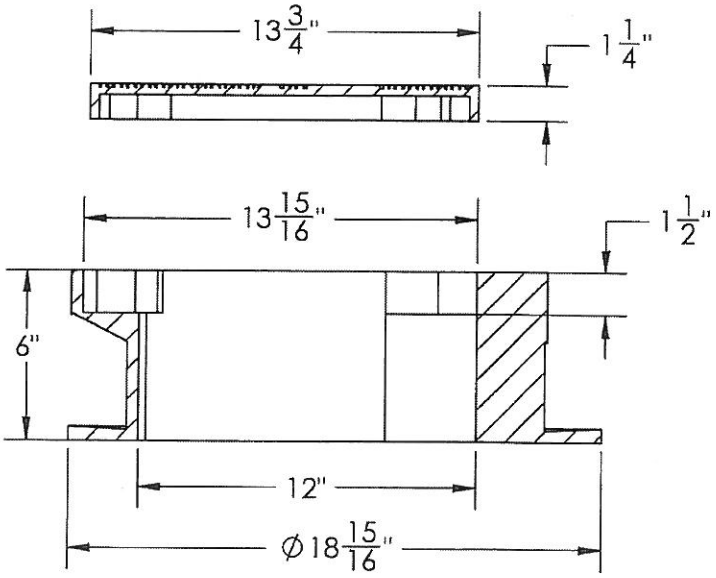




ast Iron conforms to ASTM A-48-93 Class 35B Meets H-20 Wheel Loading		**D&L model No. M-9009** Estimated Weight of M-9009 65 lbs.	**D&L Foundry & Supply** Utah Sales: (801) 785-5015 fax: (801) 785-0835 California Sales: (707) 557-4525 fax: (707) 557-4655 D&L Foundry Washington Sales: (No Sales)
Designation: M-9009	Date August 2001	Prepared by Jesse Walker D&L Supply (not to scale)	







GREY IRON CONFORMS TO ASTM A-48, CLASS 35B MEETS H-20 WHEEL LOAD

D&L PART # M-9014

PREPARED BY Mason Utter
D&L FOUNDRY (NOT TO SCALE)

DATE: 06-11-09

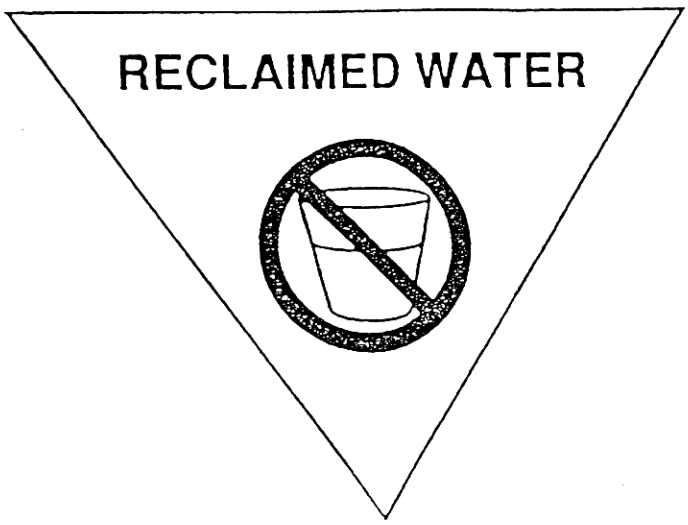
D&L FOUNDRY & SUPPLY
SALES CONTACT #
CALIFORNIA (800)-422-0848
WASHINGTON (888)-765-0054
UTAH (800)-453-9802

RECLAIMED WATER
UNIVERSAL ICON

IDENTIFICATION FOR
RECLAIMED WATER FACILITES

FIGURE B-1

VALVE BOX COVERS

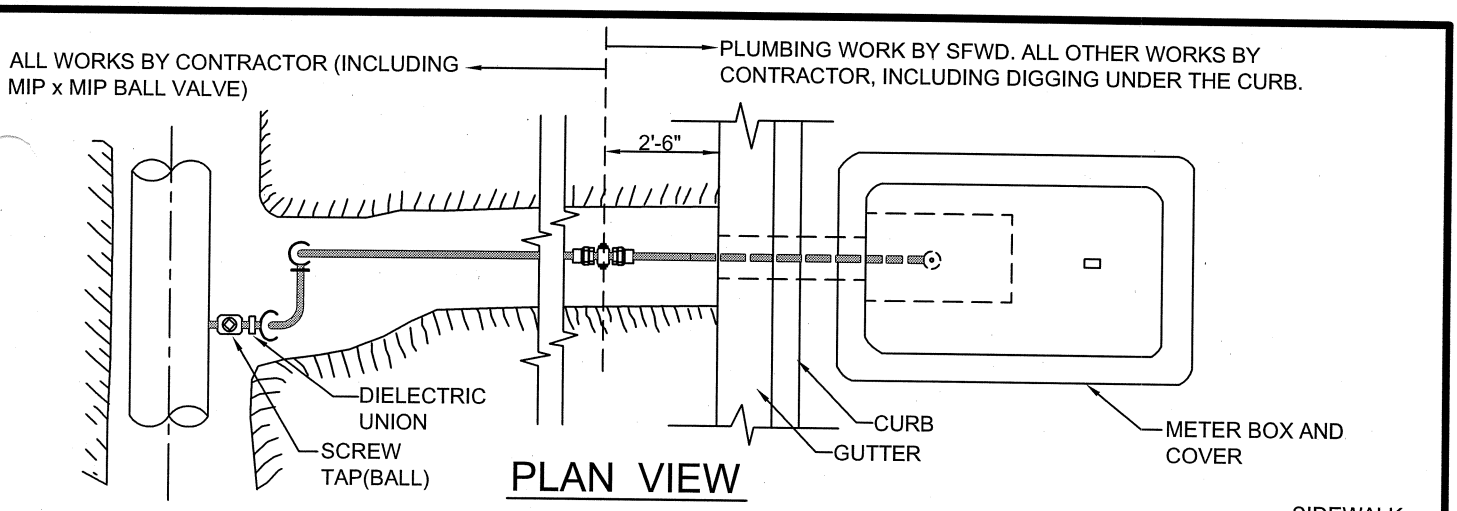


VALVE BOX COVERS:

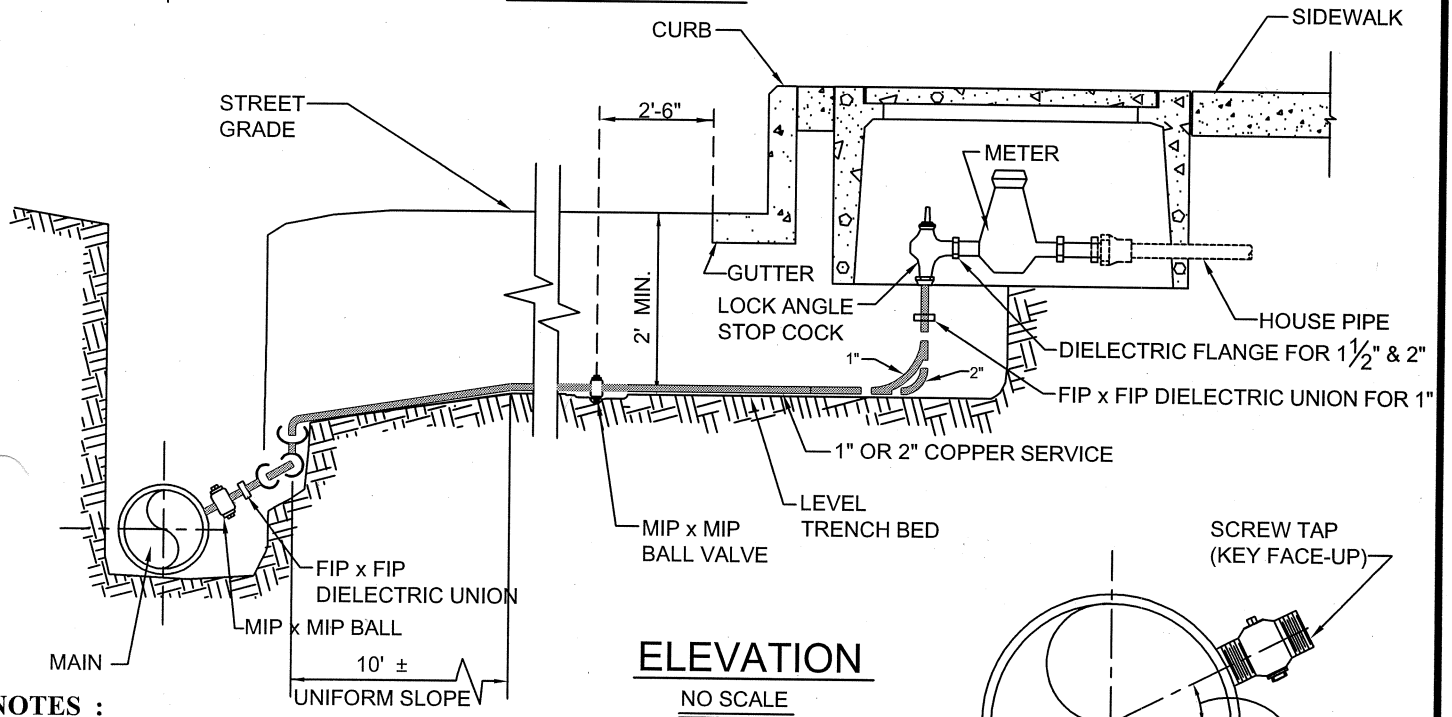
- Heavy-Duty
- Triangular
- Inscription and Icon Cast on Top Surface
- Purple (if plastic)

IDENTIFICATION FOR
RECLAIMED WATER FACILITES

FIGURE B-2

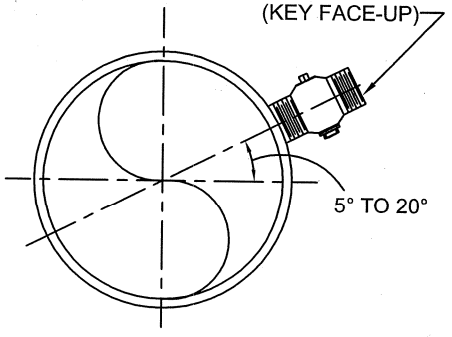

ALL WORKS BY CONTRACTOR (INCLUDING MIP x MIP BALL VALVE)
PLUMBING WORK BY SFWD. ALL OTHER WORKS BY CONTRACTOR, INCLUDING DIGGING UNDER THE CURB.
2'-6"
DIELECTRIC UNION
SCREW TAP(BALL)
CURB
GUTTER
METER BOX AND COVER

PLAN VIEW



ELEVATION

NO SCALE



SADDLE SHALL BE USED FOR 2" SCREW TAP TO 4", 6", 8" D.I.MAIN.

TYPICAL TAPPING INSTALLATION

NOTES :

1- SWING JOINT (PIPE RUNS IN TWO DIFFERENT PLANS) CONSISTING OF THREE (3) 90° ELBOWS FOR 1" SERVICE; ONE (1) 90° STREET ELBOW, TWO (2) COPPER 90° BENDS, CONNECTED BY TWO (2) 1' LONG COPPER TUBING FOR 2" SERVICE.

2- USE SOFT COPPER TUBING TYPE K FOR 1" SERVICE, HARD COPPER TYPE K FOR 2" SERVICE.

3- NOT ALL FITTINGS ARE SHOWN.

4- CONTRACTOR TO BACK FILL AND COMPACT VOID UNDER METER BOX, SIDEWALK, CURB & GUTTER.

CITY AND COUNTY OF SAN FRANCISCO

PUBLIC UTILITIES COMMISSION

SAN FRANCISCO WATER DEPARTMENT

1" & 2" LONG SERVICE RENEWAL

REVIEWED:	RECOMMENDED:	BY: THINH NGUYEN	DR: JIANMING ZHOU	DRAWING NO.
APPROVED:		CH: CHI YU	SCALE: NONE	A-1240-2A
CDD MANAGER		DATE: 10/24/2005	SUPERSEDES A-1240-2A, REV. 02	Rev. 03

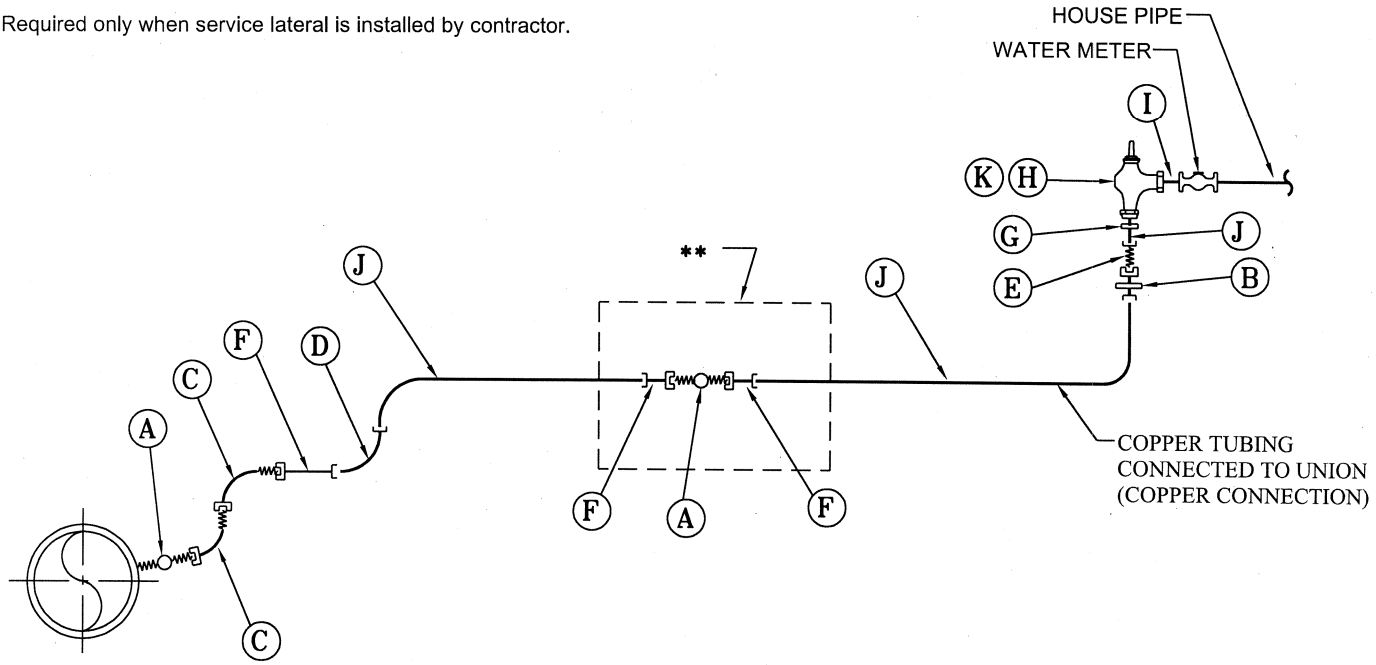
1" SERVICE RENEWAL (Long)
MATERIAL LIST
(Per Dwg. A-1240-2A Rev.05)

Prepared By: Chi Yu
Checked By: Thinh Nguyen Date: 03/24/09

QUANTITY	ITEM	ITEM DESCRIPTION	MODEL	COMMODITY CODE
2	A	1" Screw Tap, Ball, MIP x MIP, big head, lock-wing	Cambridge 311-M4M4	048-20-4312
2	B	1" Dielectric Brass Union FIP	N/A	047-35-2610
2	C	1" 90° Bronze Street Elbow, MIP x FIP	N/A	047-31-2071
1	D	1" 90° Street Elbow, Fitting to Copper	N/A	047-31-6632
5	E	1" MIP x C Adaptor	N/A	047-30-0178
2	F	1" FIP x C Adaptor		047-30-0177
1	G	1" Copper Flare Nut	N/A	047-32-9830
*1	H	1" Angle Ball Cock, Flare x Meter Swivel, w/o nut, big head, lock-wing	Ford BA23-444W-1" Cambridge 210-C4T4	048-20-4288
1	I	1" MIP x 5/8" FIP for 5/8" Water Meter 1" MIP x 3/4" FIP for 3/4" Water Meter		047-30-0042 047-30-0043
2	J	1" Copper Tubing,Soft, Length to be field determined		047-10-8684
*1	K	1" Angle Plug Cock, Flare x Meter Swivel, w/o nut, lock-wing	Ford KV23-444W-1" Jones J-1525-1" Mueller H-14255-99017-1"	048-20-4283

* Use (H) if Operating Pressure is more than 100 psi, Otherwise use (K).

** Required only when service lateral is installed by contractor.



1" SERVICE RENEWAL
(LONG)

2" SERVICE RENEWAL (Long)

MATERIAL LIST

(Per Dwg. A-1240-2A Rev.05)

Prepared By: Chi Yu

Checked By: Thinh Nguyen DATE: 03/24/09

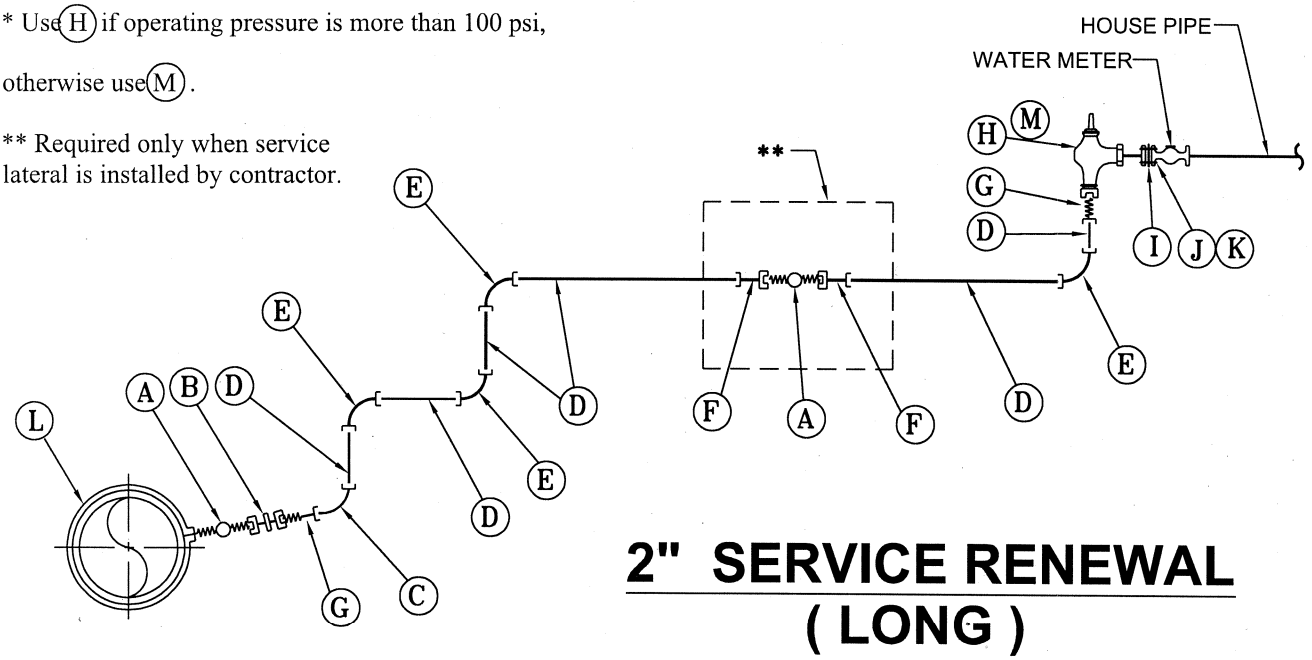
QUANTITY	ITEM	ITEM DESCRIPTION	MODEL	COMMODITY CODE
2	A	2" Screw Tap, Ball, MIP x MIP (big head)	Ford FB500-7-TA Cambridge 311-M7M7	048-20-4304
1	B	2" Dielectric Brass Union FIP		047-35-2612
1	C	2" 90° Street Elbow, Fitting to Copper		047-31-2082
6	D	2" Copper Tubing, length to be field determined		047-10-9102
4	E	2" Copper 90° Bend		047-31-2080
2	F	2" FIP x C		047-30-0170
2	G	2" MIP x C Adaptor		047-30-0172
*1	H	2" Angle Stop Cock, Ball, FIP x Mtr Flnge, (big head)	Ford BFA13-777W-2" Cambridge 210-F7MF7	048-20-4275
1	I	2" Meter Gaskets		NON-CODE
1	J	Pair of 5/8" x 2-1/2" Stainless Steel, Bolts & Nuts		NON-CODE
1	K	Pair of 5/8"x 1-1/8" Insulating Sleeves		NON-CODE
1	L	4"x2" or 6"x2" or 8"x2" Saddle Brass body, Double bronze straps, FIP, Brass or S.S. nuts & washers	Mc Donald 3826 (NPT) Mueller BR2B (IP) Ford 202B IP7	NON-CODE
*1	M	2" Angle Stop Cock, Plug, FIP x Mtr Flnge, lock-wing	Ford FV13-777W-2" Jones J-1527-F-2" Mueller H-14286-2"	048-20-4286

NOTE :

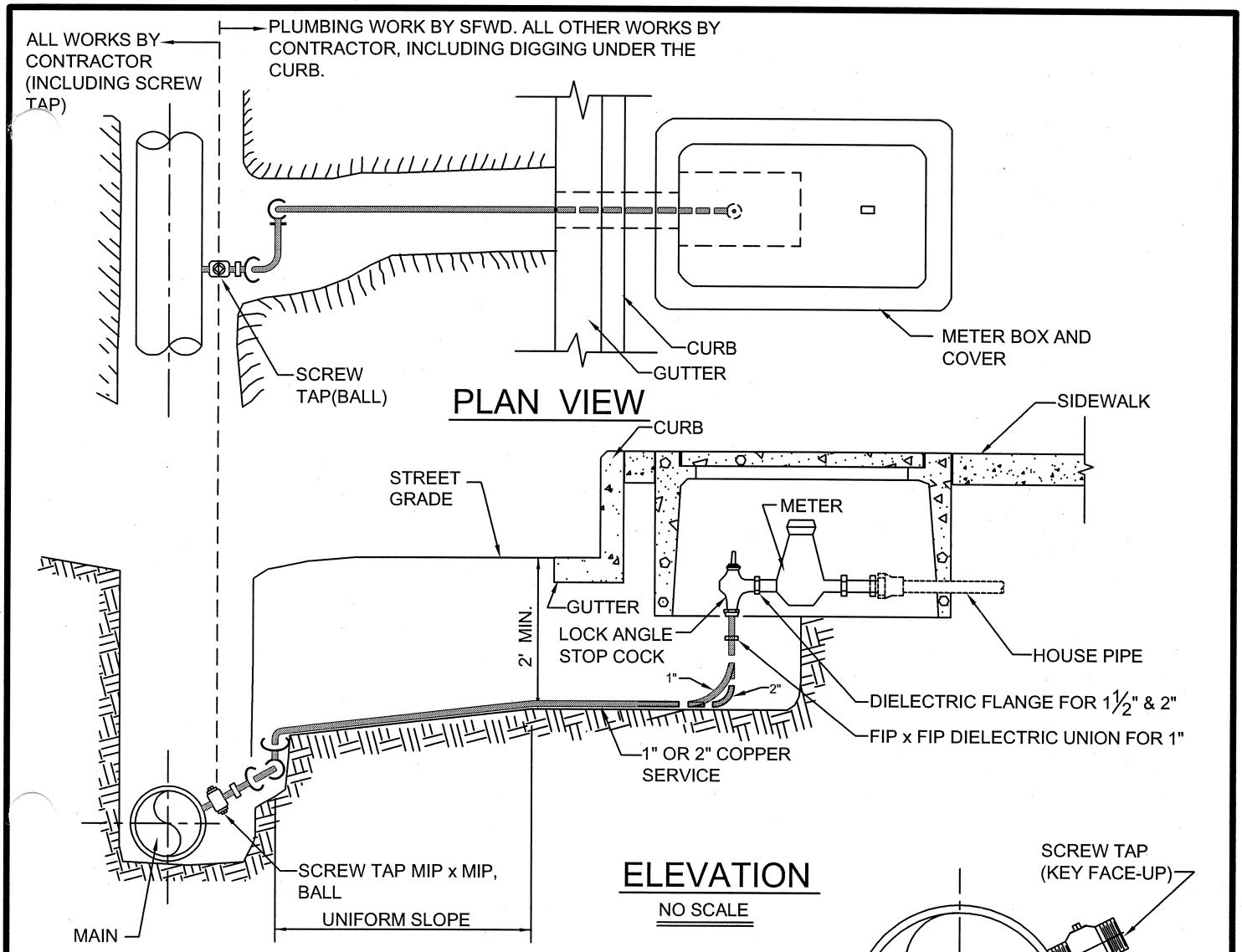
Saddle shall be used for 4", 6" and 8" mains only.

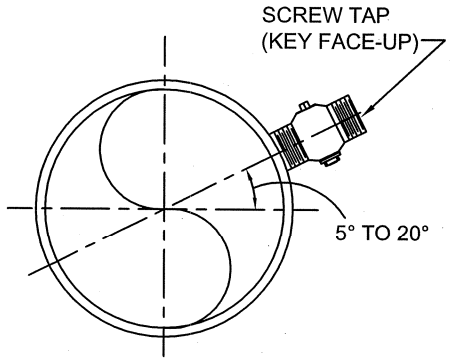
* Use (H) if operating pressure is more than 100 psi, otherwise use (M).

** Required only when service lateral is installed by contractor.



2" SERVICE RENEWAL (LONG)





SADDLE SHALL BE USED FOR 2" SCREW TAP TO 4", 6", 8" D.I.MAIN.

TYPICAL TAPPING INSTALLATION

NOTES :

1- SWING JOINT (PIPE RUNS IN TWO DIFFERENT PLANS) CONSISTING OF THREE(3) 90° ELBOWS FOR 1" SERVICE; ONE(1) BRASS 90° STREET ELBOW, TWO(2) COPPER 90° BENDS, CONNECTED BY TWO(2) 1' LONG COPPER TUBING FOR 2" SERVICE.

2- USE SOFT COPPER TUBING TYPE K FOR 1" SERVICE, HARD COPPER TYPE K FOR 2" SERVICE.

3- NOT ALL FITTINGS ARE SHOWN.

4- CONTRACTOR TO BACK FILL AND COMPACT VOID UNDER BOX, SIDEWALK, CURB & GUTTER.

CITY AND COUNTY OF SAN FRANCISCO

PUBLIC UTILITIES COMMISSION

SAN FRANCISCO WATER DEPARTMENT

1" & 2" SHORT SERVICE RENEWAL

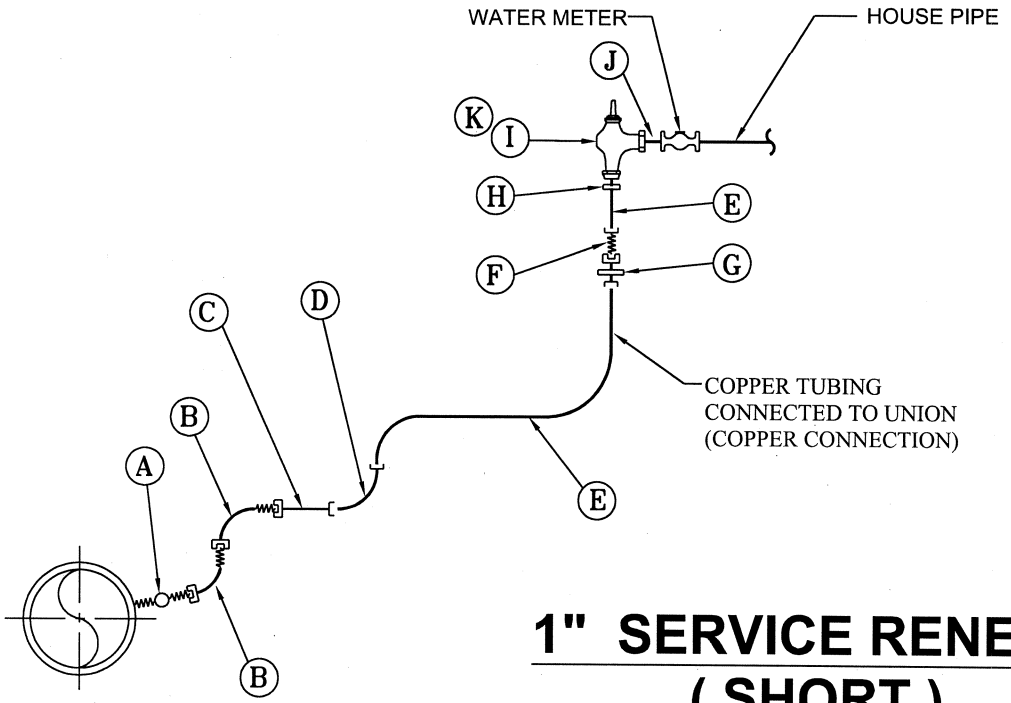
REVIEWED:	RECOMMENDED:	BY: THINH NGUYEN	DR: JIANMING ZHOU	DRAWING NO.
APPROVED:		CH: CHI YU	SCALE: NONE	A-1240-2B
CDD MANAGER		DATE: 10/24/2005	SUPERSEDES A-1240-2B, Rev.02	Rev. 03

1" SERVICE RENEWAL (Short)
MATERIAL LIST
(Per Dwg. A-1240-2B Rev.05)

Prepared By: Chi Yu
Checked By: Thinh Nguyen Date: 03/24/09

QUANTITY	ITEM	ITEM DESCRIPTION	MODEL	COMMODITY CODE
1	A	1" Screw Tap, Ball, MIP x MIP, big head, lock-wing	Cambridge 311-M4M4	048-20-4312
2	B	1" Brass, Street Elbow	N/A	047-31-2071
1	C	1" FIP x C Adaptor	N/A	047-30-0177
1	D	1" Street Elbow, 90° Fitting to Copper	N/A	047-31-6632
1	E	1" Copper Tubing, Soft, Length to be field determined		047-10-8684
2	F	1" MIP x C Adaptor	N/A	047-30-0178
1	G	1" Dielectric Brass Union FIP	N/A	047-35-2610
1	H	1" Copper Flare Nut	N/A	047-32-9830
*1	I	1" Angle Ball Cock, Flare x Meter Swivel, w/o nut, big head, lock-wing	Ford BA23-444W-1" Cambridge 210-C4T4	048-20-4288
1	J	Adapter, Water Meter, Brass 1" MIP x 5/8" FIP for 5/8" Meter 1" MIP x 3/4" FIP for 3/4" Meter		047-30-0042 047-30-0043
*1	K	1" Angle Plug Cock, Flare x Meter Swivel, w/o nut, lock-wing	Ford KV23-444W-1" Jones J-1525-1" Mueller H-14255-99017-1"	048-20-4283

* Use (I) if operating Pressure is more than 100 psi, Otherwise use (K).



1" SERVICE RENEWAL
(SHORT)

2" SERVICE RENEWAL (Short)
MATERIAL LIST
(Per Dwg. A-1240-2B Rev.05)

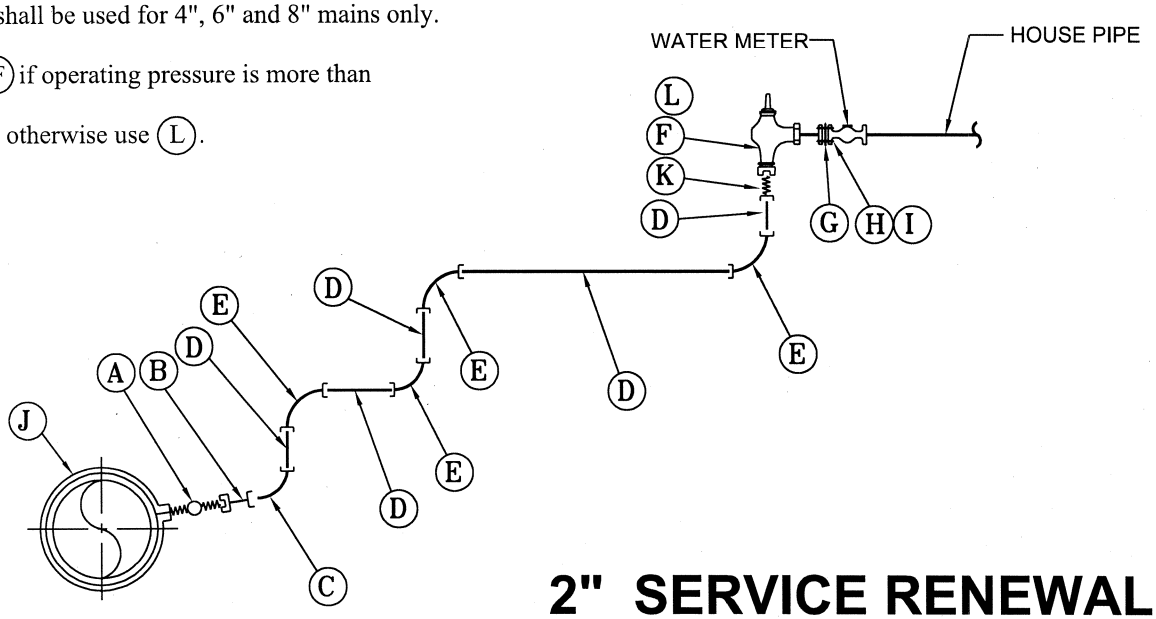
Prepared By: Chi Yu
Checked By: Thinh Nguyen Date: 03/24/09

QUANTITY	ITEM	ITEM DESCRIPTION	MODEL	COMMODITY CODE
1	A	2" Screw Tap, Ball, MIP x MIP, big head, lock-wing	Ford FB500-7-TA Cambridge 311-M7M7	048-20-4304
1	B	2" FIP x C Adaptor		047-30-0170
1	C	2" 90° Street Elbow, Fitting to Copper		047-31-2082
5	D	2"Copper Tubing, length to be field determined		047-10-9102
4	E	2" Copper 90° Bend		047-31-2080
*1	F	2" Angle Stop Cock, Ball, FIP x Mtr Flnge w/nut, big head, lock-wing	Ford BFA13-777W-2" Cambridge 210-F7MF7	048-20-4275
1	G	2" Meter Gaskets		NON-CODE
1	H	Pair of 5/8" x 2-1/2" Stainless Steel Bolts & Nuts		NON-CODE
1	I	Pair of 5/8"x 1-1/8" Insulating Sleeves		NON-CODE
1	J	4"x2" or 6"x2" or 8"x2" Saddle brass body, Double bronze straps, FIP, Brass or S.S. nuts & washers	Mc Donald 3826 (NPT) Mueller BR2B(IP) Ford 202B IP7	NON-CODE
1	K	2" MIP x C Adapter		047-30-0172
*1	L	2" Angle Stop Cock, Plug FIP x Meter Flnge, lock-wing	Ford FV13-777W-2" Jones J-1527-F-2" Mueller H-14286-2"	048-20-4286

NOTE :

Saddle shall be used for 4", 6" and 8" mains only.

* Use (F) if operating pressure is more than 100 psi, otherwise use (L).



2" SERVICE RENEWAL (SHORT)

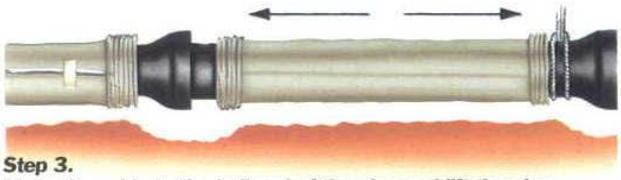
INSTALLATION OF POLYETHYLENE ENCASEMENT (AWWA C105)

(Not part of the specifications, for information only)

Method A
for Normal Dry Trench Conditions

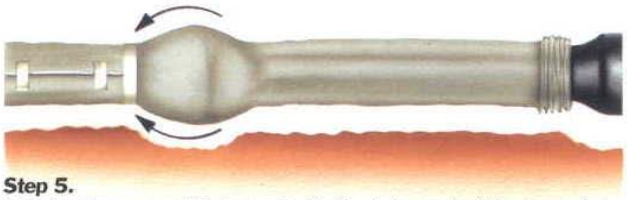
Step 1.
Cut a section of polyethylene tube approximately two feet longer than the pipe section. Remove all lumps of clay, mud, cinders, or other material that might have accumulated on the pipe surface during storage. Slip the polyethylene tube around the pipe, starting at the spigot end. Bunch the tube accordion-fashion on the end of the pipe. Pull back the overhanging end of the tube until it clears the pipe end.

Step 2.
Dig a shallow bell hole in the trench bottom at the joint location to facilitate installation of the polyethylene tube. Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe.



Step 3.
Move the cable to the bell end of the pipe and lift the pipe slightly to provide enough clearance to easily slide the tube. Spread the tube over the entire barrel of the pipe. *Note: Make sure that no dirt or other bedding material becomes trapped between the wrap and the pipe.*

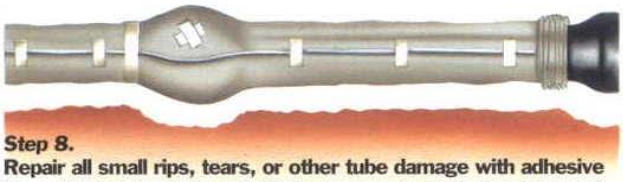
Step 4.
Make the overlap of the polyethylene tube by pulling back the bunched polyethylene from the preceding length of pipe and securing it in place. *Note: The polyethylene may be secured in place by using tape, string, plastic tie straps, or any other material capable of holding the polyethylene encasement snugly against the pipe.*



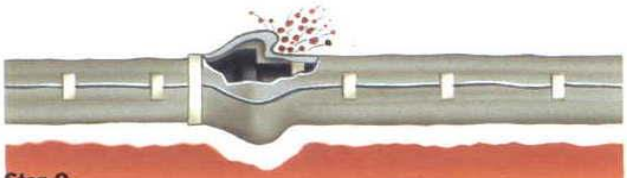
Step 5.
Overlap the secured tube end with the tube end of the new pipe section. Secure the new tube end in place.

Step 6.
Take up slack in the tube along the barrel of the pipe to make a snug, but not tight, fit. Fold excess polyethylene back over the top of the pipe.

Step 7.
Secure the fold at several locations along the pipe barrel (approximately every three feet).



Step 8.
Repair all small rips, tears, or other tube damage with adhesive tape. If the polyethylene is badly damaged, repair the damaged area with a sheet of polyethylene and seal the edges of the repair with adhesive tape.



Step 9.
Carefully backfill the pipe according to the AWWA C600 standard for backfill procedure. To prevent damage during backfilling, allow adequate slack in the tube at the joint. Backfill should be free of cinders, rocks, boulders, nails, sticks, or other materials that might damage the polyethylene. Avoid damaging the polyethylene when using tamping devices.

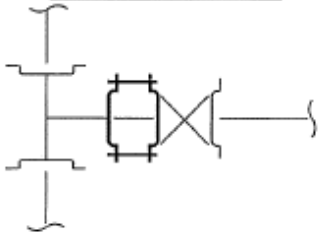
Positive Restraint in addition to Field-Lok Gasket:

-Required for first valve on branch to run

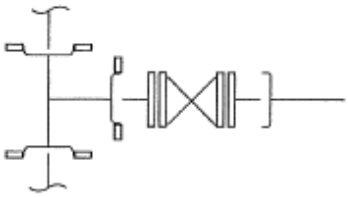
-Required for all joints 26' upstream of dead-end, hydrant and blow-off valve outlet.

Positive restraint from first valve on branch to run or bell to bell

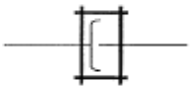
Pipe 12" or less



Pipe Larger than12"

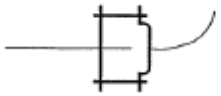


Positive restraint from plain-end pipe to pipe bell



Positive restraint from plain-end pipe to fitting bell

Pipe 12" or less



Pipe Larger than12"

Note:Use SS TP 304 3/4" tie-rods for fitting with cast-in lugs, otherwise use hardware as specified by restrainer manufacturer

LEGEND

Tyton Bell with cast-in lugs (12" or less)	Tyton Bell without cast-in lugs (larger than 12")	Plain End & Pipe Bell Restrainer (Wedge action type and tie-rod)
Tyton Bell Gate Valve with lugs	Flanged Gate Valve	Pipe Bell Restrainer
DI nipple	TR Flex Bell w/ Field-Lok Gasket	Flange by Plain End

CITY AND COUNTY OF SAN FRANCISCO

PUBLIC UTILITIES COMMISSION

SAN FRANCISCO WATER DEPARTMENT

POSITIVE RESTRAINT IN ADDITION TO FIELD-LOK GASKET

REVIEWED:	RECOMMENDED:	BY: THINH NGUYEN	DR: T. CHANG	DRAWING NO.
APPROVED:		CH: N. AU	SCALE: NONE	C-964.1 Rev. 1
CDD MANAGER		DATE: 8/06/08		

APPENDIX B

SFPUC Video Survey Requirements for Sewer Assets

SFPUC Video Survey Requirements for Sewer Assets
Effective January 2014

Video surveys of SFPUC sewer assets that are performed by outside entities must comply with the following requirements in order for them to be considered for review and/or use by the SFPUC.

All video surveys of sewer assets, including, but not limited to gravity sewer pipe, force mains, laterals, manholes, boxes, tunnels, etc., must comply with and be produced in accordance with the latest version of NASSCO standards in affect at the time. This includes NASSCO PACP, LACP, and MACP.

All assets shall be thoroughly cleaned prior to inspection and generation of the condition assessment video survey.

All video surveys shall be in PIPELOGIX compatible format and shall be NASSCO compliant. If software other than PIPELOGIX is being used by the contractor, then the database should be exported to NASSCO standard format which can then be imported into any other brand of software, including PIPELOGIX.

All video survey must have the SFPUC asset number correctly identified.

Only one asset shall be inspected per video survey.

Contractor shall obtain the following files before contract start from Mr. Alan Liu, SFPUC Sewer Operations, aliu@sfwater.org / 415-641-2372, 160 Napoleon Street, San Francisco, CA 94124, by advance appointment between the hours of 6:30 AM and 3:00 PM Monday through Friday:

- PIPES_ONLY_LATEST.mdb : Pipelogix database "seed file" includes all PUC pipes (but no inspections)
- Sewer GIS files (ESRI Shape files):
    - SEW_MAIN.shp : main sewers
    - SIDESEWERS.shp : laterals
    - CULVERTS.shp : drain leads / from drain to main
    - MH_JUNC.shp : all manhole and NON manhole junction points
- City Base map GIS files, Optional (ESRI Shape files)
    - sfBlocks.shp : ROW blocks
    - SFB_ADD.shp : Addresses
    - activestreets.shp : street centerlines with names
- UnMappedMH-New-IDs.xlxs : ID numbers for MH not in GIS/seed file; paved over, not mapped, etc.

Inspection Procedure:

1. Contractor shall use Sewer GIS files (using ArcMap, ArcExplorer, or hard copy with manhole IDs) in field to confirm ID and location of inspection start manhole

2. Using Inspection Start and Finish MH from mapping files, Contractor shall select corresponding pipe record from the Pipelogix pipe dropdown list. The contractor MUST insert "Start manhole" and "Finish manhole" from the Pipe drop down list, unless a manhole not on GIS is found.

3. In the case an intermediate manhole not shown in GIS map is encountered: Contractor shall
    a. start a new survey;
    b. use the next unused value from UnMappedMH-New-IDs.xlxs, noting value as used on UnMappedMH-New-IDs.xlxs.
    c. hand populate the following PIPELOGIX pipe header fields:
        i. Start Manhole
        ii. Finish Manhole
        iii. Street
        iv. Start MH
        v. Finish MH
        vi. Height
        vii. Shape
        viii. Material
        ix. Further Location Details with from Street, To Street
        x. PLR (using Maximo Asset ID from targeted pipe list)

Pre-inspection meetings with Collection Systems Division can be arranged through your SFPUC contact.

All completed video surveys shall delivered to Mr. Alan Liu of Sewer Operations with the database (.mdb), videos (360 or DVS), notes (rtf), pictures (snap) files and a CCTV surveys MS Word report/ index to the files being delivered. The contractor should make sure that all CCTV jobs come with the corresponding video files.

Pre-cleaning and production of condition assessment video surveys shall be borne by the developer/contractor and not the SFPUC.

Coding of the video surveys is to be performed by the NASSCO certified inspector who performed the inspection. SFPUC will review the coded video survey as part of our normal QAQC function prior to use in decision making.

Water Quality Division, Cross-Connection Control Program
P.O. Box 730, Millbrae, CA 94030-0730 • (650) 652-3199 • backflow@sfwater.org

Instructions for Certified Backflow Prevention Assembly Testers

1 Purpose

The purpose of these instructions is to set forth the responsibilities of and requirements for backflow prevention assembly testers in the City and County of San Francisco. The instructions describe the requirements for operating in San Francisco, what forms to use, and how to communicate with the various City departments involved in the Cross-Connection Control Program. Information provided by testers is used to maintain the Cross-Connection Control Program database and assists the City in creating new accounts and updating existing accounts. It is important that testers ensure the accuracy of reports and information submitted to the program.

These instructions are organized into the following sections:

2 Certified Tester Responsibilities
3 Obtaining Backflow Tags
4 Obtaining Backflow Assembly Test Report Forms
5 New Installations
6 Removal, Replacement and Relocation of Backflow Prevention Assemblies
7 Recording or Correcting Information on Pre-Printed Forms
8 Submitting Test Reports
9 Reporting Problems Observed in the Field
10 Other Information

2 Certified Tester Responsibilities

- Testers who operate within the City and County of San Francisco must hold a valid certification from the American Water Works Association, American Backflow Prevention Association, or Northern California Backflow Prevention Association. In addition, testers must obtain a Permit to Operate from the San Francisco Department of Public Health (SFDPH), which requires passing an exam, paying an annual license fee, and maintaining general liability insurance. It is the tester's responsibility to keep the Permit to Operate current.
- If a tester finds an assembly that has been modified or incorrectly installed, he or she must immediately report the situation to the Cross-Connection Control Program and ***not test the assembly***. All assemblies installed in San Francisco must be on the "Approved Backflow Prevention Assemblies" list developed by the University of Southern California (USC) Foundation for Cross-Connection Control and Hydraulic Research. Any modification of an assembly—such as relocation of valves, bypass arrangements, and jumper connections, whether temporary or permanent—invalidates the foundation's approval and is not permitted. Likewise, an assembly that has been installed in an orientation for which it was not designed or approved is also not permitted.

- Equipment for testing backflow prevention assemblies must be calibrated at least once a year. ***The tester must provide a copy of the certification to the SFDPH inspector when the Permit to Operate is obtained or renewed.***
- Testers must obtain backflow tags from the SFDPH and attach them to assemblies that have passed testing. (See Section 3 for how to obtain tags.) Note that if an assembly is a year or more overdue for testing (for example, the assembly was due for testing in October 2012 and it is now January 2013), then attach a tag with the prior year's date (in the example case, 2012).
- Testers must report test results on pre-printed forms obtained from the Cross-Connection Control Program. (See Section 4 for how to obtain forms.) When the program's new software comes on line in 2013, test results may also be submitted electronically.

3 Obtaining Backflow Tags

- Testers must obtain backflow tags from the SFDPH, located at 1390 Market Street, Suite 210, San Francisco. Tags may be obtained in person or by mail.
- Tags must be paid for by check (company or personal) or money order made out to the San Francisco Department of Public Health. Cash and credit cards are not accepted. All sales of tags are final; there are no refunds or exchanges.
- Tags may be purchased in person between 8 am and12 noon and 1 pm and 5 pm, Monday through Friday. Representatives purchasing tags will need the following information:
  - Letter on company letterhead that provides the certified tester information with his or her signature on the letter.
  - Copy of Annual License Certificate from the Tax Collector's Office.
  - Check or money order made payable to the San Francisco Department of Public Health.
- Tags may be purchased by mail with a request including the following information.
  - Name of the tester and company, if applicable.
  - Copy of Annual License Certificate from the Tax Collector's Office.
  - Number of tags being purchased.
  - Check or money order made payable to the San Francisco Department of Public Health.

4 Obtaining Backflow Assembly Test Report Forms

Note: When the Cross-Connection Control Program's new software comes on line in 2013, test report forms may be downloaded and test results submitted electronically.

- A preprinted "Backflow Assembly Test Report" must be used to report test results for existing backflow prevention assemblies. (For new installations, see Section 5.) This form must also be used if you remove or replace a backflow prevention assembly, rebuild or repair it, or do anything at a location where a backflow prevention assembly once existed. Using preprinted forms helps avoid duplicate serial numbers and various other problems within the Cross-Connection Control Program's database.
- Backflow Assembly Test Report forms are sent to customers along with the 30-day notices indicating that testing is due. The notices also include the customer's personal identification

code (PIC) and the service point identification (SPID) number associated with the assemblies at a given service address.

- Testers should first try to obtain the preprinted test report form(s) from the customer, for example, when meeting him or her at the location where the backflow assembly is to be tested. If a test form cannot be obtained from the customer in person, the tester must obtain the PIC number(s) from the customer. The tester can then get the test forms online at *www.cross-track.com* by entering his or her tester certification number and the customer's PIC number(s).
- If the customer cannot locate the PIC number(s), then the customer may obtain the PIC number(s) or preprinted test forms by calling (650) 652-3199 and asking to speak to a member of the Cross-Connection Control Program. To access his or her account, the customer must have the SPID number or service address, for multiple taps. Only the customer, not the tester, may obtain PIC numbers from the Cross-Connection Control Program if the 30-day notice is sent to a San Francisco address.
- If the 30-day notice is sent to an "accounts receivable" department outside of San Francisco, or a tester has a contract with an out-of-city customer to perform annual testing, the tester may call the Cross-Connection Control Program in the month that a site is due for testing to obtain a complete set of pre-printed test forms for the customer by mail or email. This exception is made so that testers can proceed with testing for out-of-city customers in a timely manner. Note, however, that Cross-Connection Control Program staff will contact the customer before releasing the forms, and therefore it is unlikely that the tester will receive the forms on the same day as they are requested.
- If a customer needs to obtain preprinted test forms at a time not associated with annual testing, for example, because a leaking assembly needs repair, he or she may call the Cross-Connection Control Program at (650) 652-3199. To access his or her account, the customer must have the SPID number or service address, for multiple taps.

5 New Installations

- New installations must be reported on "New Assembly Installation Report" forms, which can be obtained from the Cross-Connection Control Program or by download at *http://sfwater.org/backflow*. Note that this form should only be used in two cases:
  - ➢ If a backflow prevention assembly has never existed at the service address.
  - ➢ If a backflow prevention assembly exists at a site but has not been entered into the Cross-Connection Control Program's database, for example, it does not have an SFDPH tag. (If an assembly does not have a tag, inform the customer and the Cross-Connection Control Program immediately.)
- Enter the meter number, if known, on the New Assembly Installation Report. This information is important for associating the correct customer with a particular backflow prevention assembly.
- Under "Exact Assembly Location," try to be as specific as possible. Example 1: Building B, 2nd Floor, north wall utility closet labeled J2. Example 2: Basement, 25 feet east of the northeast corner, below stairwell.

6 Removal, Replacement or Relocation of Backflow Prevention Assemblies

- To remove, replace or relocate a backflow prevention assembly, you must obtain a plumbing permit from the Department of Building Inspection (DBI). Permits can be obtained from San Francisco's Central Permit Bureau, located at 1660 Mission Street, telephone number (415) 558-6070 or on line at *http://www.sfdbi.org/index.aspx?page=228*. To schedule a plumbing inspection, call Plumbing Inspection Services at (415) 558-6070. A copy of the signed permit must be submitted to the Cross-Connection Control Program within 30 days of approval.
- Report the removal or replacement of a backflow prevention assembly on the pre-printed Backflow Prevention Assembly Test Report. Cross out the information for the existing assembly, making sure that the original information is still legible. If the assembly being removed or replaced was tested, be sure to record the results of the test in the "Initial Test" area of the form. If a new assembly is installed, record its information in the area highlighted with a gray bar, titled "Replacement Information Below." Then record the test results for the new assembly in the "Final Test" area of the form.

  It is important that the information for both the old and new assemblies be reported on the same form. That way, the customer will have the correct serial number and associated backflow prevention assembly inactivated; the serial number and associated information for the new assembly will be entered into the Cross-Connection Control Program's database; and the old and new assemblies will be tied together in the database history.

7 Recording or Correcting Information on Pre-Printed Forms

- Do not deface, or alter beyond a legible state, any existing information on the test forms. If you need to correct information, cross out the incorrect information, but do not black it out or otherwise make it illegible.
- If you wish to add a contact to the account, such as a chief engineer or person to call, add it to the "Contact Name" field on the left side of the upper section of the test report or to the "Comments" field below the second section of the test report. The information will be entered into the Cross-Connection Control Program's database and will appear on the form the next time it is printed.
- If you believe that information on a pre-printed report is incorrect, such as the location or make of a backflow prevention assembly, contact the Cross-Connection Control Program to report the error. Staff will review the program's database and verify the information.
- If customer information (name, mailing address, or contact information) needs to be updated, the customer must contact San Francisco Water, Power and Sewer (SFWPS) Customer Services at (415) 351-3399 to have the changes made. Information will then be updated in the Cross-Connection Control Program's database by the following Monday morning.
- If a customer wishes to change the testing date to another month or synchronize multiple accounts, he or she can arrange this by contacting the Cross-Connection Control Program.

8 Submitting Test Reports

Note: When the Cross-Connection Control Program's new software comes on line in 2013, test reports may be submitted electronically.

- Test results must be submitted within five calendar days of the test date. Testers are responsible for submitting test reports.
- Submit only original, signed test reports by mail or high-resolution scan of the signed test reports by email. Faxed copies, mailed-in faxed copies, and reports that have been faxed at any time (whether before or after information has been entered into the form) are not acceptable.
- Reports that have been electronically altered in any way are not acceptable, except that information may be entered into the fields titled "Initial Test By," "Final Test By," "Comments," "Signature of Tester," "Date," "San Francisco Certified Tester's Number," and "Company Seal."

9 Reporting Problems Observed in the Field

- If a backflow prevention assembly fails a test, the results of the test are to be recorded in the "Initial Test" results area of the test form. The tester should then contact the customer and request authorization to repair the assembly or recommend that it be replaced. If the repair or replacement is not, or is not expected to be, completed within five days of the initial test date, then the tester must fax the test report showing the failed initial test to the SFDPH, Environmental Health at (415) 252-3894. The fax must be received within five days of the initial test date.
- If a tester finds a cross-connection hazard that is unprotected, that is, with no backflow prevention assembly or the wrong type of assembly, the tester must inform the customer of the hazard and potential health risk associated with it. The tester must also report the situation to the Cross-Connection Control Program immediately. An assembly that is the wrong type for the hazard should not be tested.
- If a tester finds a backflow assembly that has been modified or incorrectly installed (e.g., illegal by-pass, relocated shut-off valve, or wrong orientation), the assembly must be reported to the Cross-Connection Control Program immediately and ***must not be tested.***
- If a tester finds an existing backflow prevention assembly that is not tagged or is out of compliance with its test date, the tester must inform the customer of the need to test the assembly and must report the assembly to the Cross-Connection Control Program immediately.

10 Other Information

- Contacting Cross-Connection Control Program staff from the field can save you time and resources; often, questions can be answered or issues rectified on the spot. In addition, vital information that you might not otherwise know to record might be needed from the site.
- If test results for a given month are not received early enough to be entered into the Cross-Connection Control Program's database by the 6th of the following month, the database

automatically generates a "Notice of Violation," and the customer might receive this notice after having paid for testing. If this happens, testers should explain the situation to the customer. Testers and customers can call Cross-Connection Control Program staff at (650) 652-3199 to check on the compliance status of their accounts.

- It is recommended that testers maintain copies of the test reports they submit and records of inspections performed for three years.

Water Quality Division Contact Information

San Francisco Water, Power and Sewer
Water Quality Division
Attn: Cross-Connection Control Program
P.O. Box 730
Millbrae, CA 94030-0730
(650) 652-3199

Ron Gallega
Senior Water Services Clerk
(650) 652-3127
rgallega@sfwater.org

Online
www.cross-track.com for pre-printed test reports
www.sfwater.org for water consumer information and Water Quality Reports

Department of Public Health Contact Information

Environmental Health
1390 Market Street, Suite 910
San Francisco, CA 94102
(415) 252-3859
(415) 252-3894 fax

Department of Building Inspection Contact Information

Central Permit Bureau
1660 Mission Street
San Francisco, CA 94103
(415) 558-6070
Plumbing Inspection Services (415) 558-6070
http://www.sfdbi.org/index.aspx?page=228